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IT is with profound sorrow that we announce the death of Mr. George Shepard Page, which occurred suddenly on the morning of Saturday, the 26th inst.

BRIEFLY TOLD.

THE GAS INDUSTRY AND THE WORLD'S FAIR.—It has been said that a very effective way of ridding one's-self of an importunate applicant is by overloading him with attention; and while we are not to be taken as yielding our assent to the perfectness of that method of quieting a petitioner, we can, on the other hand, most positively assert that the World's Fair Commissioners have not tried the "overloading with kindness" treatment to any great extent in their attempt to put an end to the repeated demands of the representatives of the Gas Industry Council for proper recognition of the industry at the coming World's Fair. As our readers will remember, on February 1st the Commissioners, in answer to the petition of the Committee of the Council, allotted a certain space on the grounds whereon the Council might erect a suitable building for the purposes intended, and as outlined. Although the plot was small—only 150 by 300 feet—the concession was gracefully, if not gratefully, accepted, and word went around that, the talking stage having been passed, the time for putting up the money was at hand—that is, if the gas companies were earnest in their expressed desire that the industry should be represented in distinct and appropriate garb at the world's industrial dress parade of 1893. The person or persons, however, whose duty it was to say where the exact site for the gas building should be on the "official map," did not have a very exalted idea or opinion of the gas industry—at least from an æsthetic point of view; for Superintendent of Construction Burnham, acting in conjunction with the Secretary of Installation, thought that the neighborhood of the cattle sheds would be about the right thing. Not only were the cattle pens deemed fitting accessories, but in delicate deference to the safety of those who would visit the gas building, the site was bounded on the other side by a network of railway tracks over which it is presumed, during the busy hours of the actual exhibition, trains would be moving on a headway of perhaps 30 seconds. Having looked the location over the Council concluded that the gas visitors should not be asked to choose between escaping the horns of the steers only to be called on to dodge the approach, on either "up or down tracks," of a swiftly moving motor, and refused to accept the site. Then ensued another vexatious delay, but the persistence and insistence of the Council conquered the Superintendent of Construction, and the latter finally agreed to plot the site at the end of the annex to Machinery Hall, which means that the gas building will be located in the southwestern section of Jackson Park. The location is an excellent one, as the trains will here first land the bulk of the visitors to the Fair grounds at large. This settles once for all the fact that a building can be erected for a suitable concentrated display of the gas industry, and it only remains to add that the Council now needs money, and must have it, if the gas men mean business to the point of paying for what they are about to receive. The estimate of the Council that an average contribution representing a payment of $4 per 1,000,000 cubic feet of gas manufactured will answer every purpose—it is our belief that such an estimate is altogether too high, and further, that it would be altogether too onerous on the largest companies—and, while we do not wish to figure in any light as dictating to the Council, we think it would be better were the value of the contributions to be determined by the individual

desires of the contributors. However, that is merely a matter of detail, that will admit of adjustment without either loss of time or undue waste of gray matter.

That which is wanted is money, and the want is pressing, immediate. He who gives at once may not give double, but the speed of contribution will mean a big interest return. The proprietors of the AMERICAN GAS LIGHT JOURNAL are neither Astors nor the sons-in-law of Astors, but they have the pleasure of announcing a subscription of $250 to the World's Fair Fund of the Gas Industry Council, which subscription is at the command of the Council.

The Council, too, should remember that the various States are very anxious to have the manufacturers of gas apparatus within their borders make exhibits in the said State buildings at the Fair, and so it is doubly necessary that the Council be at once put in that position where the capacity to care for all apparatus manufacturers can be clearly specified. Subscribe, then, liberally and at once. The permanent office of the Chairman of the Finance Committee (Mr. A. C. Humphreys) of the Council is in the Drexel Building, Philadelphia, Pa. He will reply to all inquiries respecting the formalities attending a subscription to the fund.

OUTPUT AVERAGES FOR LAST HALF OF 1890–91.—It is only at this late date that we are enabled to print our tabulation of the comparison of the send-out for the last half of 1890 as against the send-out for the corresponding period of 1891. The delay, however, is not chargeable to the JOURNAL, but rather to the tardiness of our correspondents. Inquiries to the number of 103 were mailed and responses have been received from 65 companies. Summarizing the figures, the showing made is as follows:

Total output, 1891 (July to Jan.)	3,761,745,000	cu. feet.
Total output, 1890 " "	3,489,438,000	"
Increase over 1890	272,307,000	"

This represents a gain of 7.8 per cent. for the half year.

The separate meters in use for the same periods are reported at 224,458 for 1891, as against 203,956 in 1890—a gain of 20,502, or a percentage increase of 10.

These figures show a fairly satisfactory condition of the industry, and ought to open the eyes of the World's Fair managers to the magnitude of the business which they calmly said, something like a year ago, was only a back number. The test points were chosen with the sole desire of obtaining results that should be indisputable in determining the real standing of the industry. For instance, the largest cities, where the growth of the business is most pronounced—such as New York, Chicago, Philadelphia, Boston, St. Louis, etc.—were not included. In fine, the object was to attain an unimpeachable verdict. In none of the test points was a notable reduction in the gas rates ordered in the last half of '91, whereas in the half for '90 three such reductions took effect. In 41 of the points independent electric lighting companies were in competition with the gas companies. From the output figures given it will be noted that the average sendout from the test points for the 6 months was 57,873,000 cubic feet. One-fifth of the 65 show an *annual* consumption, ranging between 3 and 20 millions.

Our hearty acknowledgment of the courtesy of those who replied to our inquiries is hereby tendered.

The Market for Gas Securities.

The city market for gas shares was quite uneven during the week, Consolidated being notably sluggish and weak, the opening bid price today (Friday) coming in at 111¼, holders demanding a point higher. On the other hand, Equitable was very strong, 143 being freely offered for it without eliciting any notable transfer. Mutual, too, more than maintained the advance of a fortnight or so ago. Equitable may be a purchase at the figures quoted, but there is no doubt that profit can be made by purchasing Consolidated and Mutual at the market quotations. The various Companies now engaged in the supply of arc lights in this city are arranging a plan for consolidation, in the hope that curtailment of expenses and an increase in their service rates will put them on a sounder financial basis.

Over in Brooklyn no news of moment is reported, unless it be Judge Osborne's decision, in the case of Langan against the Union Company, impleaded with the Citizens Company, which suit was brought in restraint of the absorption by the latter of the former. The Judge decided against the Companies, but Citizens stock seems not to have suffered greatly—in fact, it is higher than before. The general consolidation scheme in Brooklyn drags. Prices there are fairly well maintained. Chicago gas is picking up again; to-day it opened at 76⅝, bid. At auction: 145 shares Brooklyn gas, at 119½–119; 5 Metropolitan, Brooklyn, at 103; 4 Fulton Municipal, at 133½; and 63 Laclede preferred, at 55.

Management.

[A Paper Contributed by Mr. T. Newbigging to the Manchester Institution of Gas Engineers.]

I do not care to be thought ambitious of playing the role of patriarch. I know very well that advice when it is cheap is often of little value; and sometimes when it is unsought we are tempted to tell the giver to "save his breath to cool his broth." And yet "a word spoken in season, how good it is!" The goodness of the advice is the test of its value. Advice may be bad as well as good; and discrimination is necessary before accepting it. The subject I have chosen to dilate upon is that of "Management"—the management of gas works.

There is a great deal in managing workmen. Some managers can do this naturally; they have a genius for it. It comes to them by nature. With others, again, it is difficult. Their natural temperament is against them. They are perhaps too self-conscious, which is usually a defect, leading them readily and on the slightest occasion, to take offense. Or they are liable to abstraction, which is another defect. It prevents a man from having his eyes open and taking a wide view. Such a one is an absent-minded man. He may possess more intellect, and be a deeper thinker, and have greater experience, than his more successful brother, but he lacks the knack or tact of the other. An objective turn of mind should be cultivated by a man who aspires to be a manager of men. That is the working mood. As a rule, perhaps, men are inclined to be subjective; and if this mood is strong upon them, they may be inventors or philosophers, but they will only be indifferent managers.

Whilst with some to manage men is a natural instinct, with others it is an art to be learned. Happily, the art can be acquired, and, in a less or greater degree, every manager should study to acquire it. Indeed, it is indispensable to success in the position he holds. The ability to manage men, and the exercise of it, smooths the thorny path of management. The wheels of the machinery run with less noise and friction; there are fewer "back-lashes" to endanger the cogs, and throw the pinions of life out of gear.

A judicious mixture of firmness, fairness and urbanity is needful for success in managing men. To be fair whilst you are firm secures confidence in your judgment, and in your character for straightforwardness. One can be firm without bluster. Urbanity is not a sign of weakness, and it sugars the pill of command. Our greatest generals have been men of quiet demeanor—not given to superciliousness. The order to do a thing should be given with a due sense and knowledge or belief that the person ordered is able to perform the duty imposed upon him. An unreasoning and unreasonable order secures its own defeat; and it is more discreditable to the person in command than to the incompetent servant.

A bond of sympathy should unite the manager and his workmen; and it is the manager who must weave it. Sympathy may well flow downwards like water; but it also rises as water does when the tide is coming in. When the waters meet, there is peace and a great stillness, and a full sense of satisfaction. Where there is indifference, the sympathetic waters recede, and there is a barren strand—or worse, for it is littered with a noxious growth that poisons the air.

In the management of men, a display of partiality and favoritism should be avoided. This does not imply that a good workman and a willing should not have the special recognition which his services deserve. To reward merit is not to show favoritism; it is simply to pay for value received.

A drunken workman is a pest and a nuisance to a manager. He may be handy and useful, and even a genius when sober. But he is never to be depended upon; and the irritation and anxiety which his unsteady conduct induces, more than outweighs his good qualities. A sober man, if more commonplace and less competent, is infinitely to be preferred.

Get rid of a spy and a tale-bearer. Such a one is nearly always the bringer of bad news; and not infrequently his story is false. A story can be false and fiendish, and yet founded on fact. There are often extenuating circumstances that alter the color of a man's conduct, or an apparently bad action. A tale bearer, in the recital of his story, takes no account of these, but rather keeps them in the background. The wound which he inflicts on his master is often greater than the ill he intends for his fellow workman. Get rid of him. If notice of dismissal is required, pay him a week's or a fortnight's wages, and let him go—consoling yourself with the reflection that his absence is cheap at the price.

A gas manager has to manage the consumers as well as his workmen; and that is sometimes as difficult a task as, and frequently a more

delicate task than, the other. To do this with success requires the play of another set of qualities. He stands in altogether a different relation to the consumers to what he does to his employers. The lever and fulcrum of command are out of place here. His straightforwardness of character is still to be manifest—that is a *sine qua non* at all times and under all circumstances. But an equable temper and a patient persistence are required. Prompt attention is expected of him; his persuasive powers have to be brought more into requisition; and a certain courtesy of demeanor has to be exercised even under aggravating conditions.

The first and chief duty of a gas manager, as such, is to aim at making the business under his charge a successful one. To that end, he will use all proper endeavors to conciliate and satisfy his customers. But he will at the same time be slow to listen to the whispers, or even the shrieks, of malignant tongues, who, without justification, and in the face of proof to the contrary, bring charges of extortion against the undertaking over which he exercises his care, and of the vileness of the commodity which he dispenses. The very success of gas enterprise makes it a mark for envy and detraction.

There is no better criterion of good management than a works kept in a state of neatness, orderliness, and method. To use a trite expression, there should be "a place for everything, and everything should be in its place"—not squandered and littered over the premises. Heavy stores, such as cast iron pipes and castings in the storage yard, should be arranged in order, according to their sizes. So with fittings of every kind in the covered stores. Old metal should have its corner assigned; and rubbish of all descriptions, if necessary to retain it, should be in a place apart. It is a mistake to choke a yard with coke. To store and hold coke is an expensive and generally unwise policy. Better clear it out at a low price than stack it like a mountain in expectation of a higher. The fact that you have a big stock defeats your object. Besides, when you sell it low, you get many people into the habit of using it. You manufacture customers; and in time there is such a widespread and steady demand as to justify a reasonable rise in price. How common is it to see the furnace ashes dumped out in a heap containing possibly 20 per cent. of good coke. This is a waste that should not be tolerated; and, generally, it would pay to have the coke handpicked from the mass.

Keep your buildings—both walls, roofs, and woodwork—in a state of decent repair. A free use of paint over ironwork is economical, and a frequent coat of limewash to the inside of the walls brightens and sweetens a retort-house. In a word, take a pride in your works, and determine that, so far as the means at your command will admit, they shall be conspicuous both as to equipment and general results—remembering that disorder and dirt mean waste; and orderliness and cleanliness, economy.

But "I am hampered by my committee," says one. A committee is often what the manager wills. If he, by integrity and assiduity, proves his competency for his position, he will win the regard, the confidence, and the support of his committee, or the sensible majority of them; and an obstructionist member will in the long run have the ground cut from under his feet, and will either be turned into a friend or retire discomfited.

The manager of a small or moderate sized gas works has often spare time on his hands. I would advise such a man not to be gadding off on every opportunity, but to employ his precious leisure usefully in the study of practical chemistry or some other branch of physical science. In elucidating the processes of his own special work, there is yet much to be done. With all that has been said and written on the distillation of coal, the process is one about which we have a vast deal still to learn. I do not for one moment believe that we have attained to anything like perfection in that very first of the process of gas manufacture. It is not without warrant that I say we are far from making the most of that wonderfully complex material—that most wonderful of all the minerals—coal. I fear we are not getting the quantity, and certainly we are not getting the illuminating value from it, that it is capable of yielding. I wish some of our young and active spirits would go into a retort when it is in action and the lid closed, and observe what is going on inside. I earnestly wish they would put their brains into it, that they would project the eye of their intelligence into it, and unravel to us the mysterious operations that are taking place there. That will be done some day by someone. If you feel that this is a task beyond your power, and that you must be content to labor on a lower plane, at least you can determine to do your "utmost best" according to your capacity; and in doing this, you will find unhappily that the way to truth is often through a certain amount of error. In the course of our investigations, it is not always possible to hit the mark at first; and we may at times be wrong both in our theory and practice. But if we pursue our studies, we shall get on to the right track in the end. It requires great courage to state one's views when they run counter to the current and orthodox and almost universal opinions that are held by high authorities; and to be heterodox in science or in art (no less than in theology) is to invite a certain amount of obloquy, and even persecution for a time. Nevertheless, to express one's views fearlessly, is to assist at arriving at the truth. If they are wrong, they can be confuted; and if right in the main, they will not want for consideration.

Finally, in the words put into the mouth of Polonius, I would say to every gas manager: "To thine own self be true, and it must follow, as the night the day, thou canst not then be false to any man."

Gas Meter Inspection, State of Massachusetts.

Mr. Charles W. Hinman, the Massachusetts Inspector of Gas and Gas Meters, in his annual report of the operations of his office for 1891, presents many facts of interest regarding the gas supply of the State. Summarizing the findings in the matter of the meter testing, the Inspector reports that during the year, 16,585 meters were inspected, of which number 16,354 were either new or repaired meters. These meters were presented for inspection either by gas meter manufacturers, or by those gas companies who repair their own meters; as the law prescribes that both new and repaired meters shall be inspected by the State Inspector before being used for measuring gas supplied to consumers. Any of these meters that failed to pass the first inspection were returned to the manufacturer or the repairer for alteration and then retested. Two hundred and thirty-one meters which had previously been in use were brought to the office and complained of as being incorrect; the complaints coming mostly from gas consumers. On reinspection 54 of these meters were found to be too fast—11 of them being more than 5 per cent. too fast, one being as much as 14 per cent too fast—the average error being 4.74 per cent.

One hundred and forty-four meters were found within the legal limits; namely 2 per cent. either way. Thirty-four meters were found to be too slow—9 of them being more than 10 per cent. slow, and one of them as much 50 per cent. slow—the average error being 10.03 per cent. One meter did not register. The average error of the complained-of meters that registered was .41 of 1 per cent. slow. Nearly all of these meters were "dry" meters.

The results of the meters complained of during the past 20 years are given in the following table:

YEAR.	Fast Meters.		Correct Meters.	Slow Meters.		Total.		Fast or Slow.
	Number.	Per cent.	Number.	Number.	Per cent.	Number.	Per cent.	
1872.....	87	4.30	81	32	9.55	202	0.32	Fast
1873.....	100	5.43	95	40	6.61	238	1.18	"
1874.....	101	4.76	131	51	6.22	285	0.57	"
1875.....	123	5.99	142	39	8.17	314	1.33	"
1876.....	148	5.19	179	53	9.17	381	0 74	"
1877.....	93	4.79	125	34	11.00	257	0.28	"
1878.....	111	5.34	180	44	9.51	343	0.63	"
1879.....	83	5.00	91	18	16.20	193	0 64	"
1880.....	48	4.54	52	22	6.59	122	0.52	"
1881.....	41	5.68	72	28	6.44	141	0.33	"
1882.....	41	4.10	62	21	11.30	127	0.43	Slow
1883.....	11	4.25	15	12	13.12	38	2,76	"
1884.....	51	4.22	100	25	5.02	176	0.58	Fast
1885.....	44	5.09	74	21	11.50	139	0.08	Slow
1886.....	38	4 55	64	22	12.43	124	0.79	"
1887.....	23	4.29	63	8	5 69	94	0.62	Fast
1888.....	56	5.22	109	17	8.71	182	0.82	"
1889.....	42	5.65	121	16	15.41	179	0.05	Slow
1890.....	64	5.32	134	20	23.60	218	0.60	"
1891.....	52	4.74	144	34	10.03	230	0.41	"

An inspection of the table shows a gradual improvement in the accuracy of the meters. This improvement is not shown so much by the average error from year to year as by the increased proportion of correct meters. During the first 5 years of the period under consideration, only 44 per cent. of the complained-of meters were correct. During the middle 10 years about half of them were correct, and during the last 5 years 64 per cent. were correct.

Such meters, however, can scarcely be taken as a fair average of those in use throughout the State, as these meters have been suspected and complained of as incorrect either by the consumers or the gas company. Comparatively few meters are complained of and brought to the office for inspection by the gas companies; for when they suspect a meter to be incorrect they usually remove it and test it themselves. As consumers are not apt to intentionally complain of slow meters, it follows that

the meters brought to this office on complaints are faster than the average of the meters in use.

The law governing the reinspection of meters provides that all meters in use shall, on the request of the consumer, be reinspected by the State Inspector, and, if found to be incorrect, the whole of the expense of reinspection shall be borne by the company. If the meter is found to be correct, the consumer pays only the testing fee and the actual expense of removing and resetting the meter. The whole expense for the ordinary sized meter does not usually much exceed $1. That only one meter in about 500 is complained of in a year shows either that the consumers are well satisfied with the measurement of the gas, or else that they are in ignorance of the terms of the reinspection of gas meters.

During the past year 6 meter provers have been graduated. This graduation is effected by means of a standard cubic foot measure, which can be filled and emptied of water, thus driving out and drawing in a cubic foot of gas. The construction of this standard measure is such that it can be used with a satisfactory degree of accuracy only under certain atmospheric conditions. Sometimes these conditions do not occur for some time, and then the graduation of meter provers has to wait.

In regard to the candle power and purity of the gas supplied in the State, the Inspector remarks that the law requires that at least two inspections a year be made of the gas of every company supplying more than 50 consumers. One additional inspection is to be made for every 6,000,000 feet of gas sold, and the gas of no company is to be inspected oftener than once a week. There are 68 companies in the State whose gas requires inspection; the number of inspections varying from 2 per year for the smallest companies to 52 per year for the largest company.

Each inspection usually comprises a determination of the illuminating value, the presence or absence of sulphureted hydrogen, and the amount of sulphur and ammonia in the gas. Additional determinations are sometimes made, such as the specific gravity of the gas and the eudiometric analysis.

The law requires the larger companies to maintain stationary photometers at some distance from their works, and these have been used for testing the gas of these companies. The gas of the smaller companies was tested by means of a portable photometer. The stationary photometers are all provided with wet meters, carefully graduated by the State Inspector, and which only require levelling and filling with water to a certain mark to assure an accurate measurement of the gas passing through them. The portable photometer is necessarily provided with a dry meter, which is frequently tested to determine its error, if it has any. These photometers are all of the ordinary type, viz., a 100 inch bar, stationary lights, and movable Bunsen disc. The candles were weighed while burning—most of the photometers using one candle, but some using two. Some of the photometers require to be used in a blackened, dark room, while others require only a partial exclusion of the light. There seems to be no difference in the indications of the two styles of apparatus. A Sugg's Argand burner, No. D., was used in testing most of the gases; but a few of the richer gases were tested with a slit burner, and sometimes while burning at a smaller rate than 5 feet per hour. The smaller rate was used only when necessary to prevent the formation of smoke. Whatever the rate of burning, the results are all given, calculated to the legal rate of burning of 5 feet per hour, on the assumption that the light given was proportional to the amount of gas used. As required by law, English standard candles, corrected to a rate of burning of 120 grains per hour, were used.

The gas was tested for sulphureted hydrogen by means of paper moistened with lead acetate solution. The amount of sulphur was estimated by burning the gas in an atmosphere containing ammonia, condensing the products of combustion, and determining the amount of sulphur in the resulting ammonium sulphate solution by a volumetric process described by Mr. Hinman in *The American Journal of Arts and Sciences*, December, 1877. The ammonia was determined by bubbling the gas slowly through a known amount of standard acid, colored with cochineal, and contained in suitable bulbs. Gas was passed until the ammonia neutralized the acid.

The tests of the gas of the larger companies were always made at some distance from the works, and usually at the companies' offices. The gas of the smaller companies was tested at hotels and town halls, as well as at the companies' offices. The inspections have been made at rather irregular intervals, and no notice has ever been given when they were to occur, so as to avoid giving the companies any opportunity of preparing a special quality of gas, if they had any such desire. More inspections have been made in the winter than in the summer so as to follow the production of gas to a certain extent. At Chicopee, Dedham, Fitchburg, Gloucester, Manufacturers' of Fall River, Marlborough, Plymouth and Webster, the inspections were made at the works, as there seemed to be no other place available.

The results of the tests made during the year by the Inspector and his assistant, and given in the following table, were furnished to the Board of Gas and Electric Light Commissioners at their request.

Larger Companies.

No. Inspections Made.	Name of Place or Co pany.	Candle Power.			Grains per 100 Feet of Gas of	
		Average.	Highest.	Lowest.	Sulphur.	Ammonia.
53	Boston	21.83	26.9	19.1	9.63	1–
11	Brookline	17.05	18.3	16.0	10.26	3.18
22	Cambridge	17.04	18.1	16.1	9.06	1.11
15	Charlestown	17.17	18.8	14.1*	9.86	1–
7	Chelsea	18.43	19.2	17.5	9.56	13.39
12	Dorchester	20.69	24.2	18.6	9.45	1–
8	East Boston	16.85	17.8	16.0	9.24	7.72
10	Fall River	23.03	25.3	21.5	9.91	1–
11	Haverhill	18.39	20.1	17.5	9.15	7.06
10	Holyoke	18.02	18.5	17.3	7.54	8.70
8	Jamaica Plain	18.32	20.0	16.8	11.45	4.14
14	Lawrence	19.49	21.1	18.1	9.86	1–
39	Lowell	17.45	18.6	16.1	10.05	3.70
12	Lynn	18.49	19.6	17.1	10.07	1–
7	Malden	16.64	17.1	16.2	8.73	1.16
9	New Bedford	17.48	18.7	15.8	13.72	2.14
10	Newton	17.51	18.3	17 0	9.87	1–
30	Roxbury	20.03	23.0	18.1	9.44	1–
8	Salem	18 00	18.6	16.7	10.42	1.91
13	South Boston	18.24	18.6	17.6	8.95	5.78
15	Springfield	18.15	19.3	16.1	9.37	2.45
8	Taunton	17.75	18.9	16.3	10.90	12.52
6	Waltham	17.08	18.4	15.8	10.70	7.98
22	Worcester	18.77	20.0	17.5	9.32	3.86
	Average	18.41			9.85	3.88

* I am informed that at the time this test was made, repairs involving a change of mains were in progress at the works. At this time the gas was necessarily sent out before it could be thoroughly mixed, and the test was made of poor gas from the last of a charge of coal.

Smaller Companies.

No. Inspections Made.	Name of Place or Company.	Candle Power.	Sulphur. Grains per 100 Feet Gas.	Ammonia. Grains per 100 Feet Gas.
3	Adams	18.73	4.57	1–
3	Amesbury	22.07	12.05	1–
3	Arlington	17.40	10 10	1.17
2	Athol	15.85	7.95	1.30
3	Attleboro	17.63	8.26	1.70
3	Beverly	17.00	8.87	1.87
4	Brockton	17.60	10.45	4.82
3	Chicopee	17.37	7.57	1.0
3	Clinton	16.53	8.97	1–
2	Danvers	16.55	10.10	1–
3	Dedham	17.50	9.83	1–
3	Easthampton	19.00	11.73	1.30
5	Fitchburg	17.84	11.06	1–
4	Gloucester	18.00	9.67	1
2	Greenfield	17.75	6.90	3.40
4	Manufacturers' of Fall River	17.42	8.07	1.27
2	Marblehead	16.70	9.15	1–
3	Marlborough	21.07	9.33	1–
4	Milford	17.07	9.55	4.55
2	Nantucket	17.00	11.05	9.15
3	Natick	17.03	8.70	1–
4	Newburyport	17.45	11.02	1–
5	North Adams	17.32	7.24	3.56
4	Northampton	17.47	10.25	13.05
4	North Attleboro	17.48	8.17	2.15
4	Pittsfield	22.12	10.25	1–
3	Plymouth	18.05	11.65	9.20
3	Quincy	16.63	9.63	9.40
3	Spencer	24.57	8.40	1–
3	Wakefield	17.30	9.10	19.30
2	Ware	17.55	9.55	1.35
2	Webster	17.45	9.05	3.55
3	Westfield	16.53	9.13	1–
3	Woburn	18.53	9.10	1–
	Average	17.99	9.31	3.09

Companies Making Petroleum Gas.

No. Inspections Made.	Name of Place or Company.	Candle Power.
2	Amherst	38.15
2	Chicopee Falls	26.75
2	Gardner	52.85
2	Ipswich	24.25

2	Lee	38.90
2	Leominster	31.05
2	Lexington	29.20
2	Middleborough	23.45
2	Southbridge	25.45
2	Stoughton	46.10
	Average	33.61

Cramer's Improved Gas Process.

U. S. Letters Patent (No. 470,007) have been granted to Mr. Anthon W. P. Cramer for improvements in methods of producing gas. Using the words of the specification, the invention consists in effecting the combustion of a mass of carbon or carbonaceous material or fuel in one chamber, in combining in controlled quantities within a special heated intermediate mixing chamber a new supply of air with the carbonic oxide arising from the combustion of said mass of carbon and passing said combined air and carbonic oxide to the bottom of and up through a mass of carbon inclosed in a third chamber to assist in its heating and combustion, and finally in passing steam at high temperature through both of said masses of carbon while in a state of incandescence to effect a complete decomposition of said steam.

In the accompanying drawings, Figs. 1 and 2 represent outside elevations of a furnace within which may be operated and accomplished the improved method of producing gas. Fig. 3 represents a vertical section, and Fig. 4 a horizontal section, of the same.

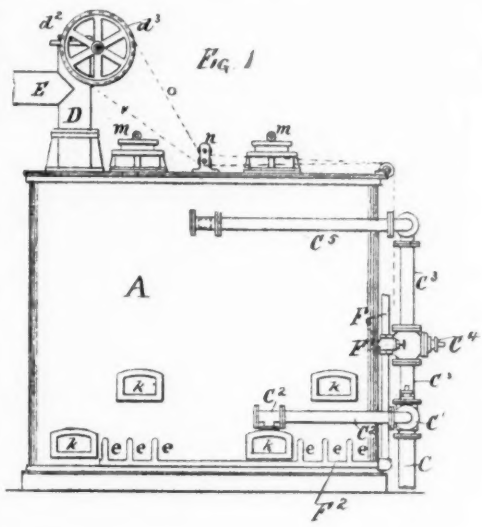
The structure is preferably built of firebrick or like refractory material inclosed in sheet metal after any of the ordinary methods. Similar letters of reference designate like parts or portions in all the figures.

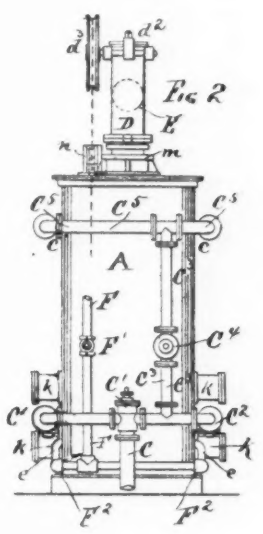
Letter *A* designates the complete furnace, comprising within its inclosure chambers *B*, B^1, and B^3, chambers *B* and B^2 having grates *b* and b^2, located to support the fuel carbon or carbonaceous material through which the steam is to be passed when in an incandescent state.

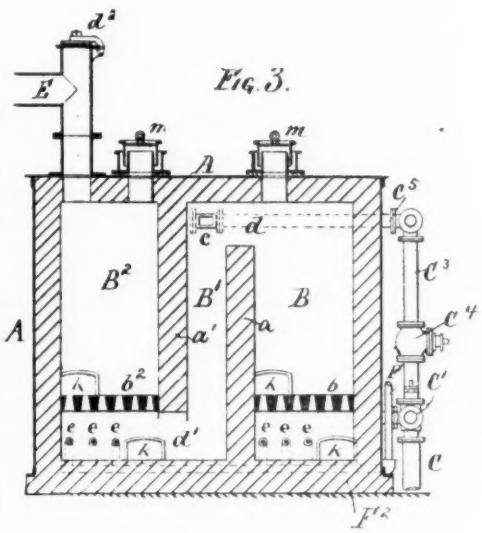
B^1 designates an intermediate chamber inclosed between the adjacent walls *a* and a^1 of the two chambers *B* and B^2, into and through which, by means of passage *d*, the carbonic oxide arising from the heating and combustion of the carbon contained in chamber *B* is passed as developed. Into this chamber B^1 a new and controlled supply of air is passed at *c*, to be mixed with the contained carbonic oxide as it moves through, thereby effecting its ignition and burning. From chamber B^1 the burning gases are passed to the bottom of chamber B^2, through passage d^1, up through the grate b^2 to heat and ignite the carbon or carbonaceous material placed upon said grate, assisting materially in the raising of the temperature of said carbon within chamber B^2 to that necessary for the reliable decomposition of the steam and effecting considerable economy in both time and fuel required. To effect a proper and economical combustion and incandescence of the carbon or carbonaceous material within chamber B^2, it is necessary to pass the draft or gases in an upward direction. With the gases of combustion from the first mass of carbon in chamber *B* forced to pass in a downward direction through the second mass of carbon in chamber B^2, a serious trouble is met with in the constantly increasing mass of ashes or incombustibles accumulating at the top of said second mass of carbon. Hence the necessity that communication should be opened between the top of the first mass of carbon within chamber *B* and the bottom of chamber B^2. The mixing chamber B^1 effects such communication.

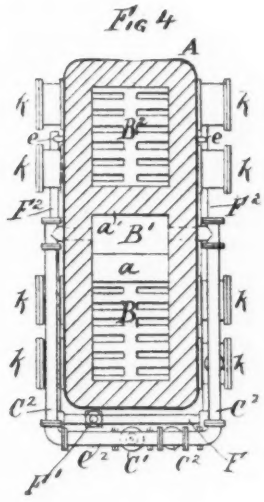
Again, without a controlled admission of new air to the carbonic oxide, and a thorough mixing of the two, its economical ignition and combustion would be doubtful and uncertain. To facilitate this mixture of admitted air with the carbonic oxide while passing through intermediate chamber B^1, side jets or tuyeres *c c* are located at its admission end to force the air to pass directly across and at right angles to the path of the carbonic oxide, and, when mixed, out with it through passage d^1.

For the admission of air for combustion purposes an air supply pipe *C* connects through a valve C^1 with one or more branch pipes C^2 for its admission to the space below the grate at the cleaning of openings *k k* of chamber *B*, and with special branch pipe C^3, valve C^4, and connecting branches C^5, for its admission to the intermediate chamber B^1 through the jets or tuyeres *c c* located on each side of said chamber B^1. For the exit of the products of combustion an uptake of chimney *D* is provided with a valve d^2 at its top end for the opening or closing of the same. For the passage of the manufactured gas out from chamber B^2, a branch *E* is made in this same uptake or chimney *D*, whereby, when the valve d^2 is closed, a free exit of said gas is provided for. To admit steam for decomposition, a supply pipe *F* connects, through valve F^1 and branch pipes F^2, with the several connecting jet branches *e e e*, through which it passes to the spaces below the grates of each of the carbon chambers *B* and B^2. While the two masses of carbon in chambers *B* and B^2 are reaching the necessary state of incandescence the valve d^2 of the uptake or chimney *D* is kept open and the products of combustion allowed to pass out. With the rising of the carbon to an incandescence or to a temperature sufficiently high for a successful decomposition of the steam, the admission of air is shut off and the chimney valve d^2 is closed tight. The steam to be decomposed is then admitted to the bottom of both chambers *B* and B^2. That admitted to the bottom of chamber *B* passes up through the incandescent carbon in chamber *B*, thence down through the intermediate chamber B^1 to mingle with the steam admitted to the bottom of chamber B^2, and with it to pass up through the incandescent carbon of chamber B^2 for continued decomposition, whence it passes out through *D* and *E*, valve d^2 being closed. When the two masses of carbon become too cool for decomposition uses, the steam is shut off and combustion drafts and air admission resumed.









THE proprietors of the Oberlin (Ohio) Gas and Electric Light Company have just been granted an electric lighting franchise by the Village Council. The plant, according to the plans proposed, is to be arranged for both arc and incandescent lamps, and the system is to be in working order by Sept 1.

The Gas Question in Des Moines, Iowa.

The following interesting matter, respecting the suit of the Des Moines National Bank to restrain the Capital City Gas Company from removing the meters through which plaintiff's supply of gas was obtained, was forwarded by a correspondent at that point. With the premise that the suit is the result of the mandatory gas ordinance recently passed by the City Council, the complaint and answer are about as follows:

The Gas Company stated in a circular to its consumers that the validity of the gas ordinance would be tested in the courts at the earliest possible moment, and it was thought that the easiest and the speediest way to get at the matter was by an injunction suit against the Company, in the defense to which the ordinance would be assailed. The suit is in equity, and it is the declared desire of both parties to facilitate its hearing and to obtain decision at the April term.

The plaintiff states it is a corporation, doing a banking business in Des Moines, and the defendant is also a corporation engaged in the business of supplying illuminating and fuel gas, and to that end uses the streets and alleys of the city for the purpose of laying pipes for the distribution of its product. The bank goes on to say it is a large consumer of gas, has pipes and fixtures all connected with the mains of the Company, and it relies wholly for illumination upon the gas furnished by the said Company, and is unwilling to part with the use of the same. The plaintiff then states that prior to February 22, 1892, it always paid at the rate of $1.80 per 1,000 feet, but that on the date named the city of Des Moines, as was its right, duly and regularly passed an ordinance fixing $1.25 as the price any Company might charge its consumers.

Under this ordinance the petition goes on to state that the defendant, disregarding and defying the terms of the ordinance and in violation of the same, now presents to and demands of the petitioner that he shall promise and agree, notwithstanding the said ordinance, to pay for all gas consumed at the rate of $1.80 per 1,000 cubic feet instead of at the rate fixed and determined by the said ordinance, and the defendant further threatens, and has served notice upon the petitioner, that it will discontinue henceforth the furnishing of gas and will cut off the supply unless the petitioner agrees to pay at the rate of $1.80, and in pursuance of its threat the defendant will discontinue furnishing gas to plaintiff unless restrained by an order of court.

The Company immediately filed its answer. After getting under way it admits the allegation that the plaintiff is a corporation and does a banking business; that the defendant is also a corporation, and that it furnishes gas, in fact admits everything charged until it comes to the binding effect of the ordinance of February. This is utterly repudiated, as of no value whatever, waste paper, nothing. The ordinance is squarely put in issue.

Then in exposition of its claim that the ordinance is invalid the following interesting statements are made in regard to cost, etc., and the details of the gas business in Des Moines:

In the first full year, 1878, which the defendant did business, it invested in property used solely for the operation of its business in furnishing gas to the city of Des Moines and its inhabitants, the sum of $168,792.36; and during the said year its gross revenue from all sources was $508.82, less than the expenses of the operation and maintenance of its said property.

In the succeeding year the amount of cash actually invested was $176,507.93,* and the profits of the business for that year were $9,295.87, being 5.26 per cent.; in 1880, the amount invested was $183,780.23, and the profits were $14,127.97, being 7.68 per cent.; in 1881, the cash invested was $198,193.37, and the profits were $20,366.64, being 10.25 per cent.; in 1882 the cash invested was $187,652.68, and the profits were $15,185.14, being 8.09 per cent.; in 1883 the cash invested was $237,909.61, and the profits were $26,346.26, being 11.07 per cent.; in 1884 the cash invested was $263,939.08, and the profits were $28,211.17, being 8.71 per cent.; in 1885 the cash invested was $274,161.32, and the profits were $21,526.33, being 7.85 per cent.; in 1886 the cash invested $273,854.61, and the profits were $21,197.79, being 7.74 per cent.

At that time the fiscal year of the Company was changed to end with the 30th day of June, and on the 30th day of June, 1887, or one year and six months from the last statement, the cash invested was $281,512.27, and the profits for that period were $32,664.10, being 7.74 per cent.; in 1888 the cash invested was $322,426.05, and the profits were $28,272.08, being 8.77 per cent.; in 1889 the cash invested was $332,934.33, and the profits were $16,959.73, being 5.09 per cent.

At this time the fiscal year of the Company was again changed to end with the 31st of December, and on the 31st day of December, 1889, or six months after the last statement, the cash invested was $346,846.91, and the profits were $25,285.13, being 7.29 per cent. In 1890, the cash invested was $373,163.81, and the profits were $25,849.91, being 8.91 per cent.

In 1891, the cash invested was $449,500.77, and the profits were $24,053.62, being 5.35 per cent. on the cash so invested.

The defendant further shows that in computing the amount of the investment as above given there is not included the sum of nearly $100,000 invested in electric light plants upon which there has been no profit whatsoever. And it further says that said statement does not include the sum of $172,096.94, paid for the right of using a large number of inventions.

The defendant avers that if said items be included (as they ought to be) the actual investment on the 30th day of June, 1889, was $520,836.02. Its profits for that year were $16,959.73, being 3.26 per cent.

On the 31st day of December, 1891, the capital invested was $687,314.92, and the profits were $24,053.62, being 3.50 per cent.

The defendant further shows that the actual reasonable and necessary cost for the last year of producing and furnishing gas to the city of Des Moines and its inhabitants per 1,000 cubic feet was $1.06; that the price fixed in said ordinance, less the discounts, which are taken advantage of by substantially every consumer, is $1.15 per 1,000 cubic feet; so that if the defendant shall manufacture and supply the same quantity of gas during the present year that it manufactured and supplied during the past year, and shall receive for all its output the maximum price fixed by the same ordinance, it would earn a profit of 9 cents per 1,000 cubic feet, or in the aggregate $4,725.72, with which to remunerate an actual cash investment of $449,500.77, being 1.05 per cent upon such actual cash, and less than seven-tenths of 1 per cent upon the capital actually invested in the property.

The defendant further shows that under established methods of doing business, not only in the operation of gas works, but of all other kinds of commerce, it is impossible to secure a maximum price from all consumers; that it is absolutely essential to make some reduction on account of quantity consumed by a particular person, firm or corporation; that, as will be seen by the statements hereinbefore made, while the maximum price for the year 1891 was $1.70 net, the average price received was in fact $1.50; therefore, under the said pretended ordinance the defendant alleges that the average price that it can possibly receive will not exceed $1 or $1.05 per 1,000 cubic feet, in which event the defendant will be compelled not only to permit its entire capital to be without remuneration or return, but will also be compelled to operate its business at an actual loss, inasmuch as it costs $1.06 per 1,000 cubic feet to make and furnish gas in the city of Des Moines.

The defendant further shows that in the statements above made no account whatsoever has been taken of the depreciation in the value of the buildings, machinery and apparatus, which comprise the greater portion of the property of the Company. No sum whatever has been charged on that account since the organization of the Company entering into the above statements. That the depreciation of the said property is from 3 to 5 per cent. annually, and if the same were deducted from the net profits of the Company for the year 1891, it would not only leave no profit whatsoever to be divided among those contributing the said capital, but would result in an actual loss. The defendant further shows that inasmuch as the profits derived from the business of the Company from its organization to the present time have not been sufficient to make a fair and just return upon the capital invested, and to provide against depreciation and the contingencies aforesaid, it has a right now to charge such prices as will enable it to recoup the losses suffered in former years.

* These percentage figures show many errors.

[Continued from page 406.]

Illuminating Flames.

[A Lecture Delivered by Prof. Vivian B. Lewes, F.I.C., F.C.S., before the London Institution.]

Analyses made by Landolt of gases withdrawn from various parts of a luminous coal gas flame, and also a long series of analyses which I have made, show that, as the gas leaves the burner, the hydrogen is the first to be consumed, and that, in the passage up the non-luminous part of the flame, the carbon monoxide largely increases in quantity, while at the same time the methane rapidly decreases, and the unsaturated hydrocarbons seem to be the least affected. In the luminous zone the unsaturated hydrocarbons rapidly disappear, while the carbon monoxide formed in the inner zone, and also the residual hydrogen and methane, undergo combustion. Professor Smithells, in a paper read before the Chemical Society in December last, also proved that, during the incom-

plete combustion taking place in the inner cone of a Bunsen flame, this same increase in the amount of carbon monoxide was to be observed. The fact that the decrease in quantity of the unsaturated hydrocarbons was but slow in the inner zone, and then took place with considerable rapidity in the luminous zone, favored the theory that they were broken up by heat in that portion of the flame, and liberated the carbon, which by its incandescence gave the luminosity. But it does not seem to have occurred to any one to try to determine whether the unsaturated hydrocarbons at the top of the non-luminous zone were of the same description as those in the coal gas.

It is a matter of common observation that the checked combustion of a luminous flame at once gives rise to the escape of acetylene, and also that, if a Bunsen burner catches light at the bottom, large quantities of acetylene are formed, of which the presence is at once detected by its distinctive and pungent odor. These facts suggested the idea that, in the inner cone of the flame, acetylene might be formed by decomposition of the original hydrocarbons; and experiment at once showed this to be the case. Of the unsaturated hydrocarbons present in coal gas, 0.8 per cent. consist of acetylene; while at the top of the non-luminous zone of a flat flame produced from the same gas, between 80 and 90 per cent. of unsaturated hydrocarbons present consist of acetylene; and in all the other luminous flames experimented with, the same action was found to take place.

On taking the most important hydrocarbons present in the coal gas, mixing them with about 20 per cent. of air, and passing them through a tube heated to the temperature existing near the top of the inner non-luminous zone, the following results were obtained: Methane gave rise to unsaturated hydrocarbons, acetylene and carbon monoxide; ethylene gave acetylene and carbon monoxide; hydrogen charged with benzene vapor gave the same; and ethane gave unsaturated hydrocarbons, acetylene and carbon monoxide. These experiments clearly show that, in the inner non-luminous zone of the flame, the heat generated by combustion of the hydrogen of the coal gas in the presence of the small proportion of air drawn into the flame at this point, causes the conversion of the hydrocarbons present in the gas into acetylene and carbon monoxide.

Acetylene is a clear colorless gas, with a strong and disagreeable odor. It consists of 24 parts by weight of carbon, combined with two parts by weight of hydrogen. It is one of those bodies which, during their formation, take in heat instead of giving it out; and it is therefore called an "endothermic" compound. Such substances are especially liable to decomposition, as this is accompanied by a rise in temperature instead of, as is the case with most decompositions, an absorption of heat. Acetylene is decomposed at a bright red heat into carbon and hydrogen, together with traces of tarry matter as well as ethylene; while Berthelot has shown it to be so unstable that it can be broken up into carbon and hydrogen by detonating a percussion cap in it.

These important points being established, it is necessary to ascertain if the temperature existing in the various parts of a flame give any clue to the actions going on within them. The beautiful platinum and platinum-rhodium thermo-couple devised by M. Le Chatelier, and introduced to us by Mr. W. Chandler Roberts-Austen, gives a means of measuring the temperatures of flames with an ease and comparative accuracy which was never before hoped for. I made a small thermo-couple of platinum and 10 per cent. of rhodium, platinum wire, using it as thin as possible to reduce errors from loss of heat by conduction, and keeping the wires of considerable length to prevent any chance of rise of temperature introducing conflicting currents at the connections with the galvanometer wires. A reflecting galvanometer was employed, and sufficient resistance was introduced into the circuit to keep the spot of light upon the scale at the highest temperature of the flame; and the scale was then graduated for temperature by taking water at 0° and 100° C. and checking the higher temperature by the fusing-points of the chlorides of the alkalies and alkaline earths, as determined by Dr. Carnelly.

With this arrangement I was able to map out the temperatures existing in the flat flame in which I had traced out the changes taking place in the constituents of the gas; and I found that the temperature rapidly rose from 500° C. half an inch above the burner, to a little over 1,200° C. at the commencement of the luminous zone—the luminous edges having a temperature of 1,216° C.; and these temperatures were further increased in the luminous zone until near the top of the flame 1,368° C was reached. This at once gives us the secret of the luminosity. From the mouth of the jet and up to a temperature of 1,000° to 1,200° C., we have the formation of acetylene from the original hydrocarbons; but the moment the requisite temperature is reached by the combustion of the hydrogen and the carbon monoxide, e acetylene decomposes, with a further rise of temperature, and the carbon heated to incandescence radiates heat and light.

If a luminous flame be cooled, its luminosity is at once dimnished, and may be destroyed; while, as the propagation of flame requires a certain temperature, a further cooling will extinguish it. In the outer edge of a flame, the rapid inrush of air sucked into the flame so lowers the temperature that a thin envelope is rendered non-luminous, the actions checked, and traces of the gas allowed to escape unconsumed by the extinction of the extreme limit of the flame; and delicate analysis shows that every luminous flame burning freely in air gives off distinct traces of carbon monoxide, acetylene and even such highly inflammable gases as methane and hydrogen.

Ever since the structure of flame has been noted and discussed, it has been accepted as a fact beyond dispute that the outer almost invisible zone which is interposed between the air and the luminous zone of the flame, is the area of complete combustion, and that here the unburnt remnants of the flame gases, meeting the air, freely take up oxygen, and are converted into the comparatively harmless products of combustion, carbon dioxide and water vapor, which only need partial removal by any hap-hazard process of ventilation to keep the air of a room fit to support animal life. The facts I have brought before you show that this is not the case; and they fully explain why gas is so oppressive in a badly ventilated apartment.

It has always been the custom to speak of flame as built up of zones; and although there are no sharp lines of demarcation, in the actions taking place, which would warrant this, still three distinct portions are visible to the eye. If we divide the luminous flames into zones, it would be perhaps best looked upon as consisting of three, viz:

(1) The inner zone, in which the temperature rises from a comparatively low point at the mouth of the burner to about 1,000° C., at the apex of the zone. In this portion of the flame, the constituents of the gas undergo various decompositions and interactions, which culminate in the conversion of the heavier hydrocarbons into acetylene—carbon monoxide being also produced; and these, with the products of combustion and residual hydrogen, pass into the next phase of action.

(2) The luminous zone, in which the temperature ranges from 1,000° C. up to a little over 1,300 C. Here the acetylene formed in the inner zone becomes decomposed by heat, with liberation of carbon, which at the moment of production is heated to incandesence by the combustion of the carbon monoxide and hydrogen, and gives luminosity to the flame.

(3) The extreme outer zone, in which, combustion being nearly completed, the cooling and diluting influence of the entering air renders a thin layer of the flame non-luminous, and finally extinguishes it. With ordinary coal gas, this results in the escape of traces of hydrogen, methane, carbon monoxide, and acetylene; while with a very rich gas unconsumed carbon also escapes.

This description of a luminous flame is of necessity far from complete, as it leaves out of consideration the interactions which lead to the formation of acetylene, and also the decompositions going on in the various parts of the flame between the products of combustion and the flame gases; but I think it marks a considerable advance in our knowledge of the main actions which lead to luminosity—the other interactions being at best subsidiary to it.

Having obtained a clear idea of the causes which lead to luminosity in flame, we are enabled for the first time to clearly understand the actions taking place in the atmospheric or Bunsen burner, the invention of which revolutionized our methods of heating by gas, and made coal gas one of the most important of our domestic fuels.

When it was first found that the admixture of a certain proportion of air with coal gas before combustion caused it to burn with a non-luminous flame, it was at once accepted, as an explanation of the phenomenon, that the extra oxygen so led into the inner cone of the flame, by causing complete combustion in the central zone, burnt up the carbon before it could be heated into incandesence, and so destroyed its light-giving power. Some years later, however, Knapp and others showed that, by mingling inert diluents, such as nitrogen, carbon dioxide, or even steam, with the gas before combustion, non-luminosity could be produced. It was then recognized that the diluting and cooling action of the nitrogen in air p'ayed an important part; and some observers held that it was this, and not the oxygen, which was the cause of non-luminosity.

On measuring the amount of air and of nitrogen respectively able to render a Bunsen flame non-luminous, they are found to be practically the same, while the quantity of oxygen present in the air used, when passed into the gas by itself, still gives a very luminous flame. This

certainly looks as if it were the nitrogen that was doing the work. If this were so, the temperature of the flame rendered non-luminous by nitrogen should be the same as that of the flame rendered non-luminous by air; but, on testing these, the fallacy of such a supposition is at once exposed. This will be seen by the following table:

Part of Flame.	Temperature existing in a Bunsen Flame rendered Non-Luminous by Nitrogen.	Air.
½ inch above burner	30° C.	54° C.
1½ inches above burner	111°	175°
Tip of inner cone	444°	1,090°
Center of inner cone	999°	1,533°
Tip of outer cone	1,151°	1,175°

These temperatures clearly show that a very considerable amount of combustion is due to the oxygen of the air, and make it perfectly manifest that both the oxygen and the nitrogen are acting in bringing about the loss of luminosity.

While working at these points, I found that if mixtures of nitrogen and oxygen, poorer in oxygen than air, were employed, it was practically only the nitrogen which acted—the diluting effect being so strong that the oxygen was prevented from taking any active part. With air, both act; while with mixtures richer in oxygen than air, the oxygen alone acts—the nitrogen being apparently unable to exercise any retarding influence. The same result is obtained if excess of air is mixed with the gas before combustion. If the quantity of air reaches a point at which the proportion of oxygen in the air is to the gas as 0.5 : 1, then the diluting influence of the nitrogen is lost, and the appearance of the flame becomes entirely altered. The normal Bunsen flame burns with a lilac-colored inner and blue outer zone; but the moment the quantity of air admitted reaches the ratio mentioned, the flame becomes short and fierce, and the inner zone changes to a greenish color—the highest temperature in the flame at the same time increasing by nearly 100° C. Experiments show that the nitrogen acts in the normal Bunsen flame by so diluting and protecting the hydrocarbons that a far higher temperature is needed for their decomposition; and this action gives time for the oxygen of the air to consume them without liberation of carbon, and hence without luminosity.

In conclusion, I think that we may express the actions which lead to the loss of luminosity in the normal Bunsen flame in the following way:

(1) The chemical activity of the oxygen introduced in the air, which, by burning up the molecules of hydrocarbons before, in their diluted condition, they undergo decomposition, causes loss of luminosity.

(2) The diluting action of the nitrogen of the air, which, by increasing the temperature necessary to bring about the partial decomposition of the hydrocarbons, prevents formation of acetylene, and in this way will, by itself, cause non-luminosity; and in the normal Bunsen flame it acts by doing this until destruction of the hydrocarbons by oxidation has taken place.

(3) The cooling influence of the air introduced, which is able to add to the general result, although the cooling is less than the increase in temperature brought about by the oxidation due to the oxygen in the air.

The Massachusetts Gas and Electric Light Commission on Electric Meters.

The Massachusetts Commissioners, in their report for the past year, make the following timely reference to meters for measuring the electric current:

The use of electric meters for ascertaining the quantity of incandescent light supplied to consumers is becoming more general, and the sale of such light by the contract system somewhat less common. There is some diversity of opinion among managers as to the expediency of using meters, and customers often find their bills largely increased when changing from the contract to the meter method of purchase. In most of the cases which have come to the attention of the Board, the increase has been because the customer has received his light under a contract which brought an appreciable loss to the company.

There are two types of meter now upon the market. In neither of these does the entire current pass through the meter, but only a portion which is shunted out or divided from the main current and maintains a constant relation thereto. In one type this shunted current passes through two plates of chemically pure zinc, and a solution of zinc sulphate in which they are suspended. The current decomposes the solution, deposits a certain quantity of zinc on one plate and dissolves an equal amount from the other, these amounts varying as the quantity of the current passing through. These plates are weighed before and after use, and the quantity of electricity used is computed from the differences in weight. In the other type the shunted current is used to excite an electro-magnet, which causes a small armature to revolve whenever the electric current passes through. The speed of the armature varies with the strength of the magnet, and this varies again as the quantity of the current. The armature is connected by toothed wheels with dials similar to those in a gas meter, so contrived as to record the quantity of current supplied to the consumer in ampere-hours or watt-hours.

The former type is known as the Edison meter, and is sold for use only with that system. The latter is adapted to the alternating system of distribution. The weight of opinion seems to be that either kind will give satisfactory results when properly set up and free from external disturbing influences.

The increasing use of meters has called attention to the possible necessity for a new basis for charges for incandescent electric lighting service. With many companies the difference between average and maximum load is very great, and the largest demand lasts but a short time. This is most marked in those companies where a large share of the business is for manufacturing or mercantile establishments which close early and require lights for only a portion of the year. Until some method of storing electric energy in large quantities which shall have greater commercial value than any now upon the market is devised, both the generating and distributing plant of a company must be capable of maintaining a satisfactory standard of light at the time of maximum load.

For these reasons machinery which is much of the time idle represents a considerable portion of the investment seeking dividends, and a question arises whether the necessary charge for this should be distributed among all the consumers of the company, or be borne by those for whose benefit the investment is made. In other words, should the entire income of the company be derived from a uniform price per watt-hour or per ampere-hour for energy supplied, or should a portion come from a fixed charge based upon the size and character of the installation and its use, in addition to the regular meter rate, which would thus be lower than under the first method.

One difficulty in the way of a satisfactory answer lies in the lack of sufficiently reliable data concerning the cost of generating and distributing electric energy. In many large stations the question is of minor importance, owing to the greater uniformity of load, but may be of great consequence where any considerable percentage of the maximum is needed for a short time only.

Dangerous Pop-Valves.

A writer in the *Engineer*, having called attention to the fact that the pop-valve is now coming into pretty general use on stationary boilers, and having noted that the item of expense connected with its installation is the chief obstacle to its universal introduction, goes on to remark:

It responds quickly when the steam pressure exceeds the working limit, and, being direct acting, it has no levers that can get cramped, and the only way it can get fast is by the valve adhering to its seat, which is not likely to happen if it receives proper attention. Moreover, the pop-valve can be locked up, so that irresponsible persons cannot tamper with it or change the pressure at which it is set.

There is one feature about the pop-valve, however, which may make it dangerous. In many cases, says a contemporary, a waste pipe is attached to the escape opening, the horizontal pipe being, say, 4 feet long, and the vertical pipe long enough to direct the outflow of steam upward, or perhaps long enough to pass through the roof so as to discharge out of doors. Usually no adequate support is provided for the waste pipes that are put out in this manner, such support as there may be being intended only to relieve the valve-casting of the weight of the pipe. Now, when the valve blows off, the escaping steam rushes upward through the escape pipe, and creates a downward reaction that brings a severe strain on the outside casing of the valve. Suppose, for example, that the waste pipe is 4 inches in diameter, and that the pressure at which the boiler blows off is 100 pounds per square inch. The area of a 4-inch pipe is 12½ inches, and a reactionary pressure of 100 pounds per square inch acting on this area would give a total downward reaction of 1,250 pounds. This, acting at the end of a 4 foot lever (*i.e.*, the waste pipe), would bring an enormous strain on the casting that forms the outside of the valve, and it should be borne in mind that this casting is all that holds the valve together, so that if the casting should fail under the strain, the entire valve would be blown from the boiler, and

in a few moments the entire contents of the boiler would be blown out. The result would probably be that the boiler would be burned before the fire could be drawn, to say nothing of the likelihood of scalding *employees*. Several accidents of this kind have come to our attention recently, and we do not doubt that others will continue to happen unless this arrangement of waste pipe is discarded. To appreciate the danger fully, one only needs to be on the top of a boiler arranged in this way when the valve blows off. It might be objected that the full head of steam is not realized at the end of the waste pipe, and that the strain at the casting would therefore be materially less than is indicated above. In reply to this we may say that even if the reactionary pressure is but 50 pounds to the square inch, the total reaction in a 4-inch pipe will be 625 pounds, and this, if the pipe is 4 feet long, will bring a bending movement on the casting of the valve of $4 \times 625 = 2,500$ foot-pounds, which is quite enough to endanger the casting if there should happen to be a flaw in it, and to bring on the bolts that fasten the casting to the neck below, a strain that is greater than they can stand with safety. If this form of attachment is to be used at all, the outer end of the pipe should have a substantial support, capable of safely bearing a weight of a ton or so; and some method of draining the pipe should be provided, in order that it may not fill with water and set back into the valve. The valve is provided with a drip opening, it is true, but it is well to incline the waste pipe downward and put an opening in it near the elbow (at the right-hand end of the cut), in order that any water in it may pass off freely without running back through the valve-casing.

We advise that the waste pipe from safety valves, if any be used, should be a simple, straight piece of pipe, without elbows and slightly dipping downwards, so that the water may run out freely. We also advise that the waste pipe should open in the boiler room, unless the available space is so small as to make this impracticable. We have known of a number of accidents that were caused by the freezing up of the outer ends of waste pipes discharging out of doors. If the boiler room is small, however, and the valve is large, it may be dangerous to blow off in the room, for pop-valves blow so suddenly that there is danger of the fireman being scalded, unless there is a large free space to blow into. Numerous fatal accidents have been caused in this way.

Setting a pop-valve under working pressure is always a dangerous proceeding. A safe way to set such a valve is to adjust it when the steam pressure is far below the blowing-off point, and test it by bringing the steam pressure up to the point at which it is desired to blow. A further adjustment is made the next time the pressure is down, and after several attempts made in this way, the valve may be brought to the desired blowing-off point. This process is a long and tedious one, and the same degree of accuracy may more quickly be attained by filling the boiler with hot water and adjusting the valve under water pressure, which may be done without danger.

The Haswell Metal-Browning Process.

Iron Age notes that the changes that occur on iron and steel and, to a lesser degree, on most metals when exposed to the air, are caused by a process of oxidation; by means of a combined action of oxygen, carbonic acid, ammonia and water on iron or other metals, the oxygen of the atmosphere combines with the metal, forming, in the case of iron and steel, red oxide of iron, well known as rust. As carbonic acid gas, ammonia and water in a gaseous state are never-missing constituents of our atmosphere, it is easily seen that the only effective means to prevent iron, steel and metals in general from rusting is by excluding the action of air and water from the surface of the metal by a coating impervious to water and air. The aim of all devices against rusting and corrosion of metals points, therefore, is to the choice of as dense and water-proof a material as possible, with which the article to be protected must be coated, and which must, besides this, fulfill the following conditions: The material of the coating must adhere perfectly to the surface of the metal, so that in case of removal of any part of it, either by a violent blow or very rough usage, the coating surrounding that spot shows no tendency too peel off.

This material must bear no chemical affinity to the metal which it is to protect; whether dry or moistened it must not create any changes on the surface of the article; it must be sufficiently hard so as not to be removed readily by wear and tear of the article when in use.

The material must show no changes when exposed to the action of moisture, water, the normal constituents of the atmosphere, and diluted mineral or organic acids, and it must stand not only usual changes of temperature, but permit of a rise of temperature up to the melting point of tin—228° C.

But above all, in order to be a perfect protection against rusting, the aggregate of the coating must be so close that water in a liquid state does not penetrate the coating. This latter condition can only be fulfilled to a certain extent, as there is no substance known, including galvanically deposited metals, to be perfectly free of pores, and we must therefore be prepared to find that the protection any coating, including the Haswell galvanic browning, can afford against the continual action of water in a liquid state can be but limited, for although the Haswell galvanic deposit, or browning, is so dense that water poured on it shows no adhesion, and can be thrown off, leaving the surface dry, as if it had previously been rubbed with oil, still, under continual action, when water remains on the surface a number of hours, a spot will show where the water commenced to penetrate, and these spots in time will show rust marks.

Steel plates coated with the Haswell galvanic deposit have stood the action of water by total submersion up to 48 hours, but this is about the limit, and therefore the inventors do not claim their deposit to be a protection against the action of water in a liquid state. They maintain, though, that their deposit stands this crucial test better than any browning or bluing hitherto achieved on iron or steel, and by far better than electro-metallic deposits such as nickel, tin or zinc.

Moist atmosphere, as well as such more or less ladened with acid fumes, as in chemical laboratories, have no deleterious effect on iron and steel articles that are browned according to Haswell's process, and in so far the inventors claim their galvanic browning to be anti-corrosive.

The browning now in use on iron and steel consists of a film of magnetic or black oxide of iron, which is prepared on the article itself by means of an alternate treating with chemicals that oxidize the surface, and heating and scratching with a steel brush; the articles (rifle barrels, for instance) undergo this procedure four to five times, taking from three to four days to complete.

In the Meritens process the steel object is fixed to the anode pole of a galvanic battery, and is inserted into hot water, where it becomes oxidized, but in this process likewise repetition of treatment is necessary, and according to Bower-Barff's system of producing the black oxide on steel or iron, the article to be treated is brought to a dull red heat in a closed vessel, while a jet of superheated steam passes over it.

The Haswell Patent Galvanic Browning Process Company, of which Frederick Howlden, 158 Broadway, New York, is manager, are introducing a process which consists in a deposit mainly of peroxide of lead, prepared by electrolysis of a suitable solution of lead salts in cold water. The deposit is produced and completed in 20 minutes, and does not require more than one treatment.

The chemical and physical properties of the Haswell electro deposit are such that it may claim a very wide field for application. It adheres perfectly to the surface, and is exceedingly hard. Articles coated with this browning bear being pressed against a circular steel brush making upward of 1,000 revolutions per minute for several seconds, and it stands rubbing hard with fine pumice stone powder, wet or dry, on a piece of felt. The aggregate of the deposit is so dense that it takes a number of hours before water penetrates the surface. The browning can be given a very high polish, gaining in appearance and density, so that it is unnecessary to polish the steel or iron surface previous to browning. Browned articles show no rust when exposed to moist atmosphere. The browning shows no change when made hot; it will bear a rise of temperature up to and beyond the melting point of tin (228° C.), and this is not affected when suddenly cooled. The thickness of the coating is about that of a thin enamel, which it also resembles, and it might therefore be designated as Haswell's electro enamel.

This system of browning seems to be principally adapted to all such manufactures that are not continually exposed to the action of water, and which have hitherto been protected from rusting by paint, varnish, or oxidized as described above.

We cannot here enumerate all manufactures to which this system of browning can be applied with advantage, but it will suffice if we mention that it has been adopted for browning rifles and other fire arms, parts of machinery, castings for indoor use (such as door handles, bolts, racks, etc.), different kinds of tools and other implements, scythes, etc., to call attention to the technical value of the invention. The cost of the browning is said to be very moderate.

ANOTHER gasholder collapse is reported from the Montpelier (Vt.) works, where a break in a guy rope was responsible for plunging the town in darkness. The accident unfortunately happened at an early hour of Sunday evening (the 13th inst.), and the result was that the church services were not of a prolonged nature.

The Coxeter Exhibit at the Crystal Palace Electrical Exhibition.

One of the interesting exhibits at the above-named exhibition is that of Messrs. Coxeter & Sons, of Grafton street, London, whose display bears chiefly on electricity in relation to medical and surgical practice, and their appliances are of such kind as would be used principally by medico-electrical experts, or those lay persons who have endeavored to study the subject, and are neither liable to be dazzled by a spark discharge nor impressed by the mere tingling shock of a Faradaic coil.

The constant batteries are shown arranged in portable boxes, provided with reversing commutator, switch for adjusting the number of cells in circuit, rheostat, and milli-amperemeter. For ordinary uses the batteries are the usual small Leclanche cells, and also a form of dry Leclanche battery which Messrs. Coxeter find specially convenient for work of this kind.

In this dry battery a sheet of thin perforated zinc is separated from an agglommerate plate (manganese, dioxide, carbon, and a trace of gelatinous matter) by about a $\frac{1}{4}$ inch in thickness of a soft gelatinous composition containing chloride of ammonium. Contact is made with the agglomerate by a thin plate of iron carbonized on one face, and the whole is inclosed in a wrapping of paraffined paper. Elements of this battery about $4\frac{1}{2}$ inches long, $1\frac{1}{2}$ inches wide, and $\frac{5}{8}$ inch thick, are used in the portable sets, and are both smaller and lighter than the usual ebonite-cased Leclanches of similar output, forty of the former occupying the space of sixteen of the latter. One of these small dry cells, will serve for ordinary house bell, being set flat behind the base board, and we understand that through low resistance it will give a current of 2.6 amperes, although in ordinary medical practice, small currents are ordinarily required. As an example it may be mentioned that a current of 6 or 7 milli-amperes serves for the destruction of hair roots by electrolysis, a fine platinum electrode being inserted into the hair follicle, while the destruction of fibroids or tumors by a similar process, may involve a current of 200 milli-amperes, about 20 cells serving to give the required potential (28 volts). For the galvanic cautery either accumulators or a low resistance primary battery, such as the bichromate battery or Grove's battery, serves best, and an ingenious form of cautery knife is that suggested by Dr. Stevenson, in which a platinum edge running round a porcelain blade is maintained in a state of incandescence by the current.

The small incandescent lamp for ordinary surgical use in examining cavities is mounted on a pencil-like stem containing a spiral resistance, a spring sliding on this serving to control the brightness of the light; for lamps the Leclanche battery, accumulators, or a small hand dynamo may be used according to the capacity of the lamp. As an example of an endoscope for searching the more inaccesible cavities of the body, we may refer to one in the form of a catheter, or a rod about $\frac{5}{16}$ inches in diameter and between 8 inches and 9 inches long. At the tip is a minute incandescent lamp, and at a slight bend close to the end is a reflecting prism, which, in conjunction with a focussing arrangement of minute lenses in the shaft of the instrument, enables the surgeon to distinctly see the illuminated part. Such an endoscope might occasionally be useful to the engineer for examining interiors. Incandescent lamps of larger size with suitable adjustments and reflectors are now almost essential for the operating table.

A small electric hammer used in tooth stopping consists of an electromagnet at the top of the pencil like body, and the armature of this magnet strikes a rapid series of blows on the end of a rod passing through the body of the instrument, a spring giving the backward movement. The armature is kept in oscillation by a contact breaker something like that of the ordinary induction coil, but so far reversed, that the breaking contact happens when the armature closes down on the magnet. This arrangement, with a cutting tool attached, is shown as an electric engraving arrangement, and it cuts rapidly into brass or copper when used pencil fashion. Another mechanical tool is the small dental engine in which a Sturgeon or Siemen's armature is at the upper end of the pencil-like body, and light fields surround this. A neat arrangement adopted by Messrs. Coxeter for regulating the medical or Faradaic induction coil is by short-circuiting more or less of the primary, a course which involves less waste space than the clumsy "damping" cylinders often used. For the short circuiting a hole is drilled between the two convolutions of the primary so as to just cut into both layers of wire, and a wire sliding in the drilled hole serves as the regulator. Arrangements for the medical use of static electricity, and also a very complete electrical cabinet for hospital use, are shown, and altogether Messrs. Coxeter's exhibit is interesting as illustrating the present state of electro-technology in relation to medical and surgical practice.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, March 10, 1892.

Prof. Lewes on the Spontaneous Ignition of Coal.—Mr. John Gill on Gas and Electricity.—The Gas Light and Coke Company's Rating Appeals.—Electricity at the Crystal Palace.

A very interesting paper on the spontaneous ignition of coal and its prevention, was recently read before the Society of Arts, by Prof. Vivian B. Lewes, a gentleman whose name is becoming quite a household word in connection with matters of this sort. He is Professor of Chemistry at the Royal Naval College, and as such has had his attention directed to the serious accidents that occur to coal laden vessels while out at sea, on account of spontaneous combustion, as it is called, taking place in the cargo; and the main object of the paper is to offer suggestions as to the possibility of preventing or at least diminishing the risk of these casualties, which lead to considerable loss of life and property every year. Laudable as such an object is, the paper would not come within my province, did it not also contain a great deal of valuable information for gas engineers and all who have to deal with large cargoes of coal. Everybody knows that coal fresh won from the pit is much more valuable to the gas maker than that which has been stacked for a time. It is the practice in many gas works to use the freshly delivered coal as closely as possible, only adding to or taking from the stock on hand as circumstances may necessitate. And, therefore, we look to the utterances of such an authority as Prof. Lewes for some hints as to distinguishing the relative liability, or otherwise, of a coal to spontaneous ignition, and the means to be adopted for preserving it. Evidently the same actions which become evident as spontaneous ignition are concerned in a lesser or slower degree with the degeneration of stacked coal. It would be impossible to give in a short space a fair abstract of the lecture, but one or two important conclusions may just be glanced at. One of these is the fact that "the higher the amount of moisture held by the coal, after exposure for some time to dry air, the greater will be its power of absorption for oxygen, and the greater, therefore, its liability to spontaneous heating and ignition." This is a matter that can be easily fixed by experiment. Then it is pointed out that small coal is much more liable to ignition than large, by reason of the increase in active absorbent surface exposed to the air. Especially does this hold good in the case of coal that is shaken up by long railway journeys, shunting, etc.; or crushed by being shot down a spout or shoot, to be followed by a considerable quantity of the same cargo. Wet coal is much more likely to fire than dry, and Prof. Lewes is opposed to the very general practice of ventilating large stacks of coal. His suggestions with regard to the storage of coal on land include the use of sound weather-tight stores, fireproof throughout. The coal should not be stored in wet weather, or heaped to a depth greater than 8 feet. Every care should be taken to avoid breaking or crushing, no accumulation of small should be allowed, nor should the coal be put into store within a month of its being brought to bank. An air-dry coal that does not contain more than 3 per cent. of moisture, and when powdered and heated to about 250° F. in an oven for three hours, does not increase more than 2 per cent. in weight, may be looked upon as a safe coal to be stored in bulk. Of course it would rarely be possible to follow all these instructions to the letter, but they are none the less useful as serving to point out the directions in which we must work to secure the best results from our coal.

I have again the unthankful office of referring to one of the numerous reckless and ill-digested attempts to compare electricity with gas, of course to the detriment of the latter and the corresponding puffing of the new light, that are being put forward either by those whose enthusiasm outruns their common sense, or by those who have some ulterior purpose to serve. In the last issue of the AMERICAN GAS LIGHT JOURNAL to hand, I find some extracts from a lecture by Mr. John Gill, Engineer of the Peterborough Water Works. This paper should not be read without the criticism upon it that appeared in the *Gas World* from the pen of Mr. Denny Lane, of Cork. As an example of the care with which Mr. Gill has worked up his subject, it may be mentioned that he has overlooked the fact that coal distilled for gas making yields anything besides gas, but puts it on the same footing as that used under a boiler for generating steam. And he states the price of gas in his native town at 5s. 4d. per 1,000 cubic feet, whereas it is sold at 3s. 2d. and 3s. 4d. Those who have the real interests of electricity at heart may well say, "Save me from my friends."

An important contribution to the subject of the valuation of gas works, for arriving at the ratable value, has been furnished by the ap-

peal case of the Gas Light and Coke Company, which has occupied a small army of barristers, solicitors, engineers, accountants, valuers, etc., for 20 days, and is not quite completed yet. In every parish or union of parishes there is an assessment committee, whose duty it is to see that the ratable value of all the property is kept up to the full. As they see a gas undertaking enlarging they increase the valuation, and if the Gas Company object the only way is to appeal, and then the case comes before a law court. The peculiarity of the case in question is the large area covered by the stations and mains of the Company, including over a hundred parishes. The Company were prepared to accept a valuation of something under half a million sterling, but the assessment committees wanted a great deal more. So far it appears likely that the total value will be fixed at about £600,000, and then there will be a nice little problem to allocate this sum amongst the parishes concerned. The evidence given by the engineers and accountants furnishes interesting and instructive information on the financial aspect of gas works administration.

The exhibition of electrical appliances at the Crystal Palace comprises all kinds of apparatus for the utilization of electricity, arranged upon a popularly attractive rather than an educational or commercial basis. So that the student who goes there with a hope of improving his knowledge in regard to modern developments of electricity, or the practical man who hopes to find out something definite about the cost of applying that mysterious agent, for lighting, motive power, or otherwise, will not be greatly assisted. There is nothing corresponding to the scientific lecture, or the cookery demonstrations, that are distinctive features of gas apparatus exhibitions. Since the promoters claim that the exhibition is a means of affording useful aid to those who are already inclined to adopt electricity, it is surprising to find that these important points are uterly neglected, and that the whole thing appears to be laid out rather for the delectation of the holiday seeker, who looks for some new sensation to wile away an hour or two, than for purposes of more solid instruction. It is entertaining, no doubt, to inspect an electromotor contained in an ordinary walnut shell, a fountain lit up by electric lamps, or various whimsical devices composed of electric lights, but one expects something more. Many of the exhibits appear to comprise nothing but prettily arranged devices in porcelain pushes, carbons, etc., garnished with tasteful upholstery arrangements and surroundings, and these not only answer no good purpose, but obscure the really novel things that are to be seen. So with regard to the lighting devices. It is easy to make a great illumination with fireworks or magnesium wire, but that does not prove anything on the score of practical adaptability.

As compared with the show that was held at the same place about 10 years ago, several signs of advancement are to be seen. The most important, perhaps, are the combinations of engines and dynamos on one bed plate. Engines have been introduced that can be driven at a speed of several hundred revolutions per minute, and that are capable of generating a very high power in proportion to the space they occupy. Nor must I omit a notice of the gas engines, which really form a respectable show of themselves, worthy the inspection of any gas engineer, and furnish evidence of considerable improvement. Evidently the gas engine is going to be an important ally to us in the future. Not only have driving belts been entirely dispensed with, in some apparatus, but greatly improved forms have been introduced in others, with a view, of course, to prevent the partial or total failure caused by the slipping or breaking of an ordinary belt. Many different kinds of conducting systems have been brought out, the most noticable being that consisting of a combination of copper strips or ribbons, laid naked upon insulated supports in a small conduit or subway. They admit of repeated increase as the business is developed. Then there are the transformers, for converting high tension into low tension electricity, and storage batteries or accumulators for maintaining a regular supply. There seems to be a great deal of activity as regards the latter. No advance is evident in the matter of lamps, either incandescent or arc. The ornamentation of the glow lamps has been carried to a fantastical extent. They are enclosed in sea shells, covered with colored shades of all kinds, and what seems most absurd of all, with strings of colored beads. Several examples of practical electric lighting are shown, including sumptuously furnished bed rooms, parlors, etc., and the noticeable feature about these is that where three or four gas burners would be deemed ample lighting, from six to twelve of the so-called 16-candle electric lamps are used. There are examples of high power tower lighting, search lights for ships at sea, etc. The application of electric lights for the production of sunrise, moonlight and other theatrical effects is illustrated, and the curious visitor can have a cup of tea, the water for which is boiled by electricity, or a cutlet fried by similar agency. Several applications of electric motors, for driving sewing machines, knife cleaners, ventilating fans, etc., are also on view, to say nothing of tram cars, cranes, lifts and other machinery.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At the annual meeting of the Atlanta (Ga.) Gas Light Company the following officers were elected: Manager, W. G. Abel; Assistant Superintendent, E. P. Page, Jr.; Secretary, W. S. Cosgrove.

Supt. William Tracy, of the Alton (Ill.) Gas and Electric Light Company, writes that the new electric lighting annex was started for the first time on the 14th inst., and the "breaking in" was perfectly satisfactory. The lamp capacity of the annex is 85 arcs and 700 incandescents. The Superintendent will remodel the old electric lighting building for office purposes, and a feature of the offices will be the provision made for suitably displaying a collection of gas heaters, cookers, etc. Mr. Tracy says he will be greatly disappointed if he does not place at least 50 large stoves the coming season.

At the annual meeting of the Passaic (N. J.) Gas Light Company Mr. Walston R. Brown (who is Mayor of the city) was elected President, and Mr. E. Le Baron Gardiner was elected Treasurer. It was decided to increase the capital stock to $100,000 (it is $85,000 at present), the money so obtained to be devoted to increasing the capacity of the plant. The Secretary of the Company (Mr. Norton) declined a re-election.

Some time ago the janitor of the New Haven (Conn.) Town Public Buildings complained at a meeting of the Selectmen that the town was paying for gas that should be paid for by the city. Auditor Lake thereupon instituted an investigation, which disclosed the fact that the reverse was the case—the city was paying for gas consumed in the Registrar's room and in the janitor's quarters. The New Haven Gas Company was instructed to make the necessary meter changes.

The electric light plant at Bismark (N. Dak.) was sold out about a fortnight ago. The purchaser was A. C. H. Schweiss, who it is said acted for the town authorities of Brenham, Texas; the latter having had a desire for some time to engage in a municipal venture of this sort.

The taxpayers of Hudson, Mass., have negatived the proposition to purchase and operate an electric lighting plant on municipal account.

The Denver Consolidated Gas Company has declared a quarterly dividend of 1 per cent., payable April 1.

The Equitable Gas Light Company of this city will pay a quarterly dividend of 2 per cent. on April 15. Transfer books close April 1, to be reopened on April 16.

The following are the main features of the proposed Board of Gas and Electric Light Commissioners, as per the bill introduced in the Maryland Legislature by Mr. Conway W. Sams. A condensed account of this was given in our issue for March 14, and it may be here added that the sentiment so far developed in respect of the fate of the measure is all against its passage.

Section 1. Be it enacted by the General Assembly of Maryland, That the Governor shall appoint three citizens of this State, who shall constitute a Board of Gas and Electric Light Commissioners, and the Governor shall designate the chairman thereof. Said Board shall appoint one of its members as Secretary, who shall keep a full and faithful record of its proceedings, and shall serve such notices and perform such other duties as the Commissioners may require, and shall be sworn befor entering upon the discharge of his duties.

Sec. 2 provides that term of office shall be three years; that the Governor may remove any Commissioner for cause, and shall fill vacancies by appointment.

Sec. 3 provides that the Commissioners shall be sworn and shall not be either directly or indirectly connected with any gas or electric light company.

Sec. 4. The annual salary of the Secretary of the Board shall be $1,500, and that of the other Commissioners $1,000, to be paid monthly from the treasury of the State.

Sec. 5. The Commissioners shall keep an office in the city of Baltimore in which their records shall be preserved, and may expend a sum not exceeding $1,000 annually in procuring necessary books, statistics and stationery, and in defraying expenses incidental and necessary to the discharge of their duties, including the rent of their office.

Sec. 6 provides that all expenses of the Board shall be borne by the gas and electric light companies in proportion to their gross earnings, and details the manner of collecting the money from them.

Sec. 7. Every gas and electric light company shall annually make a

return to said Board on or before the 1st day of October, and in a form prescribed by said Board, setting forth the amount of its authorized capital, its indebtedness and financial condition on the 30th day of June preceding, and a statement of its income and expenses during the preceding year, together with its dividends paid or declared, and a list containing the names of all its salaried officers, and the amount of the annual salary paid to each; and said return shall be signed and sworn to by the president, treasurer and a majority of the directors of said company. Every such company shall also at all times on request furnish any statement or information required by the Board concerning the condition, management and operations of the company, and shall comply with all lawful orders of said Board.

Sec. 8. Said Board shall have the general supervision of all corporations within the State engaged in the manufacture and sale of gas or electricity for light and fuel, and shall make all necessary examinations and inquiries and keep themselves informed as to the compliance of the several corporations with the provisions of law.

Sec. 9. Upon the complaint in writing of the mayor of any municipal corporation in which a gas or electric light company is located, or of 20 customers of any company, either as to the quality, price or pressure of the gas or the quality or price of the electric lighting furnished by such company, the Board shall notify the company of such complaints by leaving at their office a copy thereof, and shall thereupon, after notice, give a public hearing to such petitioner and such company, and after said hearing may order, if they deem it just and proper, any reduction in the price or improvement in the quality of the gas or electric light furnished by such company, or any increase or decrease in the pressure under which the gas is supplied; provided, however, that said Board may not order any reduction in the price of gas in Baltimore city to a price less than $1 per 1,000 cubic feet, nor any increase in the candle-power beyond 25 candle-power of the standard established by law, nor any increase in pressure beyond such as is necessary to support a column of 2½ inches of water. And the said Board shall take such action as is necessary to carry into effect its orders, and a report of the proceedings and the result thereof shall be included in their next report to the Legislature.

Sec. 10. The Board shall, from time to time, ascertain with what degree of purity the gas companies can reasonably be required to make and supply gas, and at what pressure; and if any legislation requiring purity in gas or designating the pressure at which it should be supplied is deemed desirable or expedient, it shall so report to the Legislature in its next report.

Sec. 11 provides that the Board may, through the Attorney-General, enforce the obedience of gas and electric light companies to the laws and to the lawful orders of the Board itself.

Sec. 12 provides for a report from the Board to each session of the Legislature with suggestions as to legislation.

Sec. 13 provides for a fine of $50 per diem for each case of delay or refusal to make returns as specified in section 7.

Sec. 14. This act shall take effect upon its passage.

ONE of the flimsiest based suits for damages that was ever brought before a court in good faith was that called a fortnight or so ago, before Judge Van Epps in the City Court, Atlanta, Ga. The plaintiff was John Govon, an auctioneer, who sued the Atlanta Gas Company for $10,000, on account of injuries to person. At some period in 1889 one of Govon's children was ill, and complainant was obliged to watch by her bedside during a portion of the night. On one of such nights plaintiff believed that the sick one had gone to sleep, and in that belief turned the gas jet down very low, and retired to an adjoining room to rest. About two hours afterward plaintiff returned to the sick room, there to find that the light was extinguished. He stepped on a chair for the purpose of relighting the jet, but the chair turned, and Govon fell to the floor with sufficient force to fracture his leg. He asked for damages on the ground that the accident was traceable to the negligence of the Company in not keeping up a sufficient gas pressure in the mains. Judge Van Epps ordered a non-suit. Plaintiff's argument was ingenious, to say the least.

MESSRS. HUME & CHANDLER, who are largely interested in the gas works at Macomb, Ill., have purchased a controlling interest in the works at Boonville, Mo. They will make important improvements on their new property.

THE proprietors of the Nantucket (Mass.) Gas Light Company have at last determined to take advantage of their opportunities, and will expend a considerable sum in plant betterments. It is proposed to put in a new carbonizing apparatus and to erect a gasholder; and, better still, to overhaul the street main system. In fact, if they did nothing else than to attend to the latter they would achieve surprising results in the matter of cutting down expenditure for gas-making materials, to say nothing about receiving more money for gas sold that is now worse than wasted.

THE Worcester (Mass.) Company's new holder is to be completed early this summer.

IN our report of the discussion on Mr. Wood's paper on "The Manipulation of Oxide," read before the New England Association of Gas Engineers, which will be found in our last issue, Mr. Wood is reported as having said (page 400, second column, last sentence of first paragraph)—"I have run up as high as 150,000 feet, and our figures on the average are 100,000 to the *barrel*, in the lifetime of the material." For *barrel* read *bushel*.

THE Troy (N. Y.) Gas Company has disposed of the plot of ground and building on the corner of Williams and Liberty streets, formerly occupied by it as a storage yard and house.

"ORION," writing from San Francisco under date of the 14th inst., forwards the following: "Within the week the managers of the leading hotels in the city held a meeting in Parlor A of the Palace Hotel to decide what should be done in reference to the arrest of the hotel managers (referred to in our last issue) for violating a city ordinance concerning fixtures and their inspection in hotels, lodging houses, etc. The ordinance in question, which went into effect about a year ago, but which has not been enforced, requires that the Gas Inspector shall every three months examine the various gas pipes and fixtures and plumbing to see that no gas escapes, and that the sanitary condition is perfect. Each hotel manager is also required to fill out a blank to the effect that the ordinance has been complied with. The ordinance requires one other thing which, at one and the same time, provoked the ire and mirth of the hotel men. It was that the legend—

Don't Blow Out the Gas.

should be hung conspicuously over the gas jets. The hotel men declared that nine out of every ten would consider such a notice an affront to their intelligence, and that the first thing they would do would be to tear it down. One hotel man recounted his experience to the effect that he had posted such notices and his guests took them down immediately, threatening to leave if they were replaced. Among those present at the meeting were Capt. C. Percy Smith, of the Palace; Major Hooper, of the Occidental; 'Lucky' Baldwin, of the Baldwin; and S. H. Seymour, of the Russ. The Grand, California and Lick were also represented by others acting for the proprietors. On consideration it was decided to employ counsel and test the validity of the ordinance."

ONE of the holders of the Lynn (Mass.) Gas and Electric Light Company suffered a total collapse, on the night of March 18th. The holder, which had a capacity of 150,000 cubic feet, was about two-thirds inflated, when (owing to a very severe gust of wind, during the continuance of a veritable gale from the northwest) an ominous grinding called the attention of the yardman to the fact that the vessel was out of equilibrium. An alarm was at once sent out and the entire works' force were speedily engaged in an attempt to save the structure from complete wreck. Do what they could, however, the vessel slowly settled, and virtual collapse occurred at 11 o'clock on Saturday morning. From a cut of the ruins, as printed in the Lynn *Item*, of Saturday, March 18, it seems that the striking blow of the gale that caused the damage acted first on the northwest side of the holder, well toward the topmost point of the exposed sheets, causing the southeast or opposite portion to sink with a violence sufficient to wrench those guide wheels from their bearings, the subsequent rebound virtually duplicating the wrenching on the western side. The cut shows seven of the columns standing, with the holder crown on the southern side resting in the tank, the crown possibly being 5 feet above the tank coping, whereas on the northern side the crown top is fully 15 feet above the coping. At the time of the collapse the holder contained perhaps 100,000 cubic feet of gas, but neither explosion nor shock attended its escape. The holder had been in service for about 20 years, and will be replaced at once. The loss to the Company, exclusive of the contents of the holder, is put at $10,000. There was no marked interruption or disarrangement in the gas supply of the city.

IT is understood that the arc lighting companies of this city will consolidate.

MR. A. G. RICAUD, the Mayor of Wilmington, N. C., invites proposals for the public lighting of the city by means of electricity. The competition closes on Friday of this week.

ELSEWHERE we note the institution of a suit at Des Moines, Iowa, which is primarily brought for a trial of the merits of the gas ordinance recently passed by the Council. Since our receipt of this news we have information that the trial is progressing, and our correspondent also incloses a report of the testimony given for defendants (the Capital City Gas Company) by Messrs. Louis Lilly and Walton Clark. We submit the same:

"Mr. Lilly having been sworn, testified that he was an expert accountant and had been employed to examine the books of the Capital City Gas Company. He had no personal knowledge of the disbursements of the Company, but gave what information he possessed from an examination of its accounts. He gave as the result of his examination that the total cash investment at the end of 1891 was $339,500.77, on which the profits were $24,053.36, or 5.35 per cent. The total amount which has been paid out since 1878, the date of the organization of the Company, to stockholders in dividends and bondholders for interest was $46,256.68. In addition to the amount actually invested in the Des Moines gas plant, given above, the witness testified there had been invested in patents $172,069.94, and in the electric light plant $65,717.21, making the total investment $687,314.92; profits on the same, $24.053.62, or 3.05 per cent. He further stated that in giving the cost of the plant he did not include anything but cash actually expended. The witness stated the gross revenues were $79,588.27, and gave all the items. The expenses were $55,454.75, divided as follows: Manufacturing, $38.903, less received from residuals, such as coal tar, etc., $11,732.13, making the net cost of manufacture $27,170.87; distribution, $28,273.88. The total amount produced was 52,508,527 feet, making the cost per 1,000 feet $1.0561. He said the costs for distribution were economical. The taxes paid aggregated 11.3 cents per 1,000 feet. He reiterated the statement that in making up his figures no account was taken of deterioration of the plant or interest on investment. The salaries paid the Secretary and the Manager aggregated $4,000 per year. In the expense account these were the only officers on the payroll, the President and Treasurer of the Company receiving nothing. He stated that the estimated profits of the Company for the coming year, on the assumption that the disbursements remained the same, would be $4,725.72, a trifle over 1 per cent. on the cash actually invested, in the gas plant, and less than 1 per cent. of the real investment. This decline in profits was explained by the statement that the decrease was owing to the substitution by the city of electric lights for gas lamps.

"On cross-examination, Mr. Lily stated that he was not a regular employee of the Company and had been engaged for about three weeks in the present examination. He explained that for about four years he had, at the request of stockholders and the officers, been employed to examine the accounts of the forty different gas concerns scattered throughout the country, whose central office is in Philadelphia. Mr. Dudley led him through the complicated mass of figures he had introduced in evidence, but the witness seemed to know what he knew and was not easily confused.

"Mr. Clark, also of Philadelphia, was the next witness. He stated that he occupied the position of consulting engineer to the United Gas Improvement Company, one of the largest gas companies in the world, which owned the Capital City Gas Light Company. He was consulted before any improvements were made by the Philadelphia Company, and had been consulted with regard to all the betterments made in Des Moines since 1888. He had been a gas engineer since 1873, and was thoroughly conversant with every detail of the gas business, both as to the construction of plants and their operation after construction. He superintended the erection of many in all parts of the country. The witness was asked if he was familiar with the plant of the Capital City Gas Company in this city. He replied that he was, and, in regard to much of it, had been consulted before its construction. He was then asked what he thought was its reasonable cost. He replied, 'From $450,000 to $475,000.' This testimony was to show that the construction had been economical and the investment on which interest was expected was not a fictitious one. He then passed into the details of the plant. He stated that the gas was made under the Lowe patents, or otherwise the water gas principle; that the machinery in use was of the latest design and nothing antiquated; that the same general system has this year been put into New York, into London, and in many other places he named, by the company he represented. This much testimony was introduced to show that the expenditures for plant as given by the books of the Company were reasonable, and the machinery modern. The witness then passed on to the actual cost of gas and the details of its manufacture.

"The witness said there was, as far as he knew, one city in the country which made gas for 75 cents, Wheeling, although several supplied it for $1. Mr. Cummins asked him if it cost more to make gas in Des Moines than in other places. He replied that it did, and made a comparison with Wheeling. He said in that city, in the first place, the city owned the plant, and were therefore relieved from taxation. In Des Moines the Capital City Gas Company paid 11.3 cents per 1,000 feet on this account. Gas coal in Wheeling can be obtained for $1.58 per ton; in Des Moines the cost is $5.23. A ton of coal makes 10,000 feet. It will thus be seen gas in Des Moines costs, on account of coal alone, 36 cents per 1,000 more than in Wheeling. In Des Moines the rent charges are .047 per 1,000 feet, in Wheeling the city furnishes offices free; the candle power of Des Moines gas is 25 per cent. higher than Wheeling. This makes an additional cost of .0284 per 1,000. Wheeling distributes 115,000,000 feet, Des Moines 52,000,000. The cost of distribution and general expenses is therefore proportionately greater in Des Moines by 10 cents or more per 1,000. These items added together make the cost of gas in Des Moines above that in Wheeling .6884 per 1,000 feet. From this amount 6 cents per 1,000 must be deducted, increased value of the residuals, coke, coal tar, etc., in Des Moines, making in these items the net cost of manufacturing 58.84 cents per 1,000 feet more in Des Moines. In addition the witness said there were other items difficult to form estimates upon. Wheeling distributes 115,000,000 feet and Des Moines 52,000,000. The leakage is proportionately less. The witness believed gas was made as economically in Des Moines as in Wheeling."

ABOUT a fortnight ago Mr. and Mrs. W. W. Prichard, of Ironton, Ohio, celebrated the 25th anniversary of their wedding day, on which occasion they received the congratulations of many of their friends. A feature of the repast served during the evening was that the wants of the guests were ministered to by the children of the happy couple, nine of whom have blessed their union. May their future life be as happy and even as their past has been, and that will truly be a golden one!

IT is with deep sorrow that we report the death of Ellen, wife of Mr. Charles Nettleton, of this city, and mother of Mr. Charles H. Nettleton, of Birmingham, Conn., who passed away on Friday, March 18. Deceased was in her 67th year, and her life was that of a noble woman.

AT the annual meeting of the shareholders in the La Crosse (Wis.) Gas Light Company, the following officers were re-elected: President, Mr. John Vincent; Secretary, Treasurer and General Manager, Mr. George McMillan. The results of the year's business operations were so satisfactory that the Company decided to, and has already entered into contract for a No. 5 Wilbraham gas exhauster and engine on same bed plate, together with usual bye-pass, etc.; also for two benches of 5's to be set over semi-regenerative furnaces from plans made by Mr. McMillan. This furnace has been thoroughly tested in the La Crosse works, where other examples of it have been in use for some years. The Company will also install a 50-horse power horizontal boiler, and arrangements have been made for placing 4¾ miles of additional mains. These improvements and extensions will be commenced as soon as the state of the weather will permit, and will be pushed to completion without delay. Manager McMillan evidently has enough work in prospect to keep him busy during the coming season, and it may be taken for granted that he will complete it to the satisfaction of his employers and himself.

THE Bristol (Pa.) Gas Company has declared a dividend of six per cent. out of the earnings for the past year.

WE understand that John B. Smith, Joseph Birkbeck, Harvey Jeager, J. J. Robbins, John Flanigan and J. T. Morgan have incorporated the Consumer's Gas Company, with a capital of $25,000, and claim the right to subsequently increase the same to $300,000. They propose to ask for a franchise to build and operate a works in Wilkes-Barre, Pa., and as a bait to the authorities they hold out the promise to sell gas at a rate not to exceed $1.25 per 1,000. It is understood that the Company is an offspring of a Philadelphia parent Company, that proposes to raid established companies in Pennsylvania. Of course, they have a "process," under which they can manufacture water gas cheaper than it can be produced by any other system; but as the old Wilkes-Barre Company is equipped with what the water gas experts are pleased to term "a water gas plant up to date," we imagine that Messrs. Coyngham and Smith, of the old Company, are amply able to take care of the Consumer's backers' rather diaphanous bluff. If we mistake not, the net gas rate at Wilkes-Barre is $1.60 per 1,000.

WE regret to announce the death of the Hon. E. H. Woodman, Treasurer of the Concord (N. H.) Gas Light Company, who died at his home in that city on the morning of the 21st inst. Particulars in our next.

THE AMERICAN GAS LIGHT JOURNAL

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PROPRIETORS.

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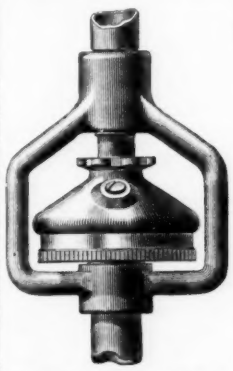

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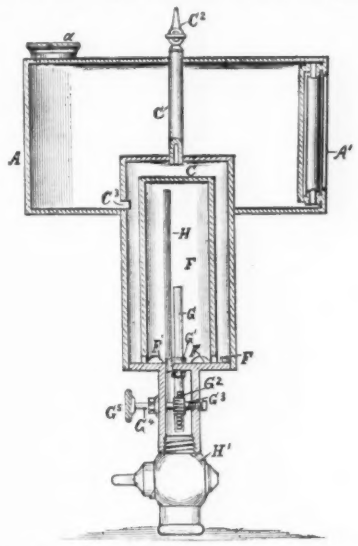

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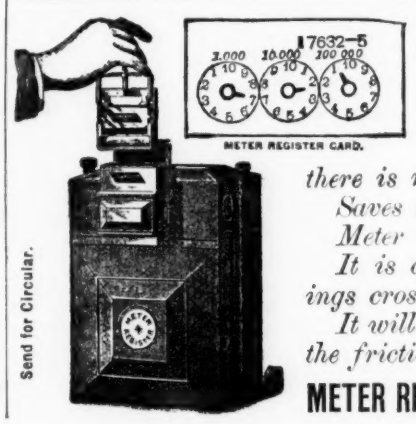

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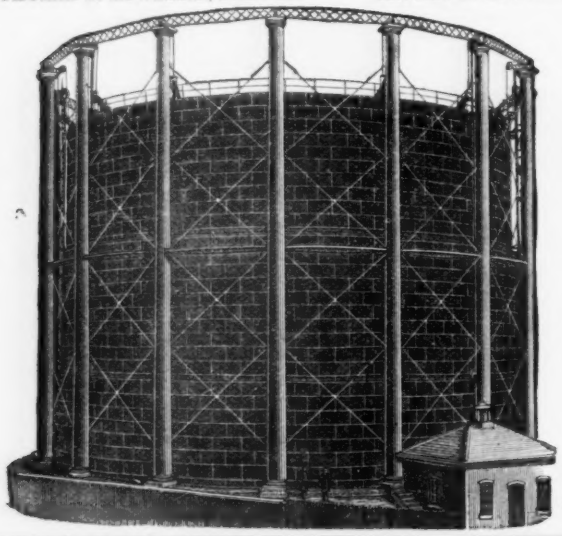

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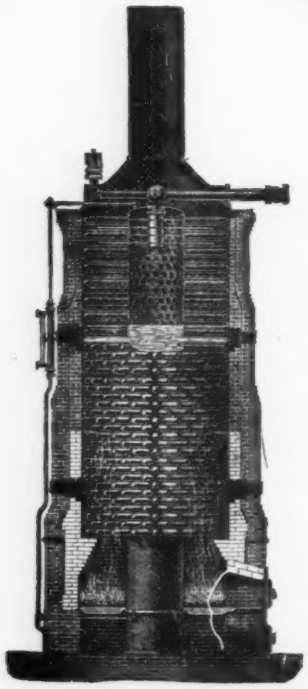

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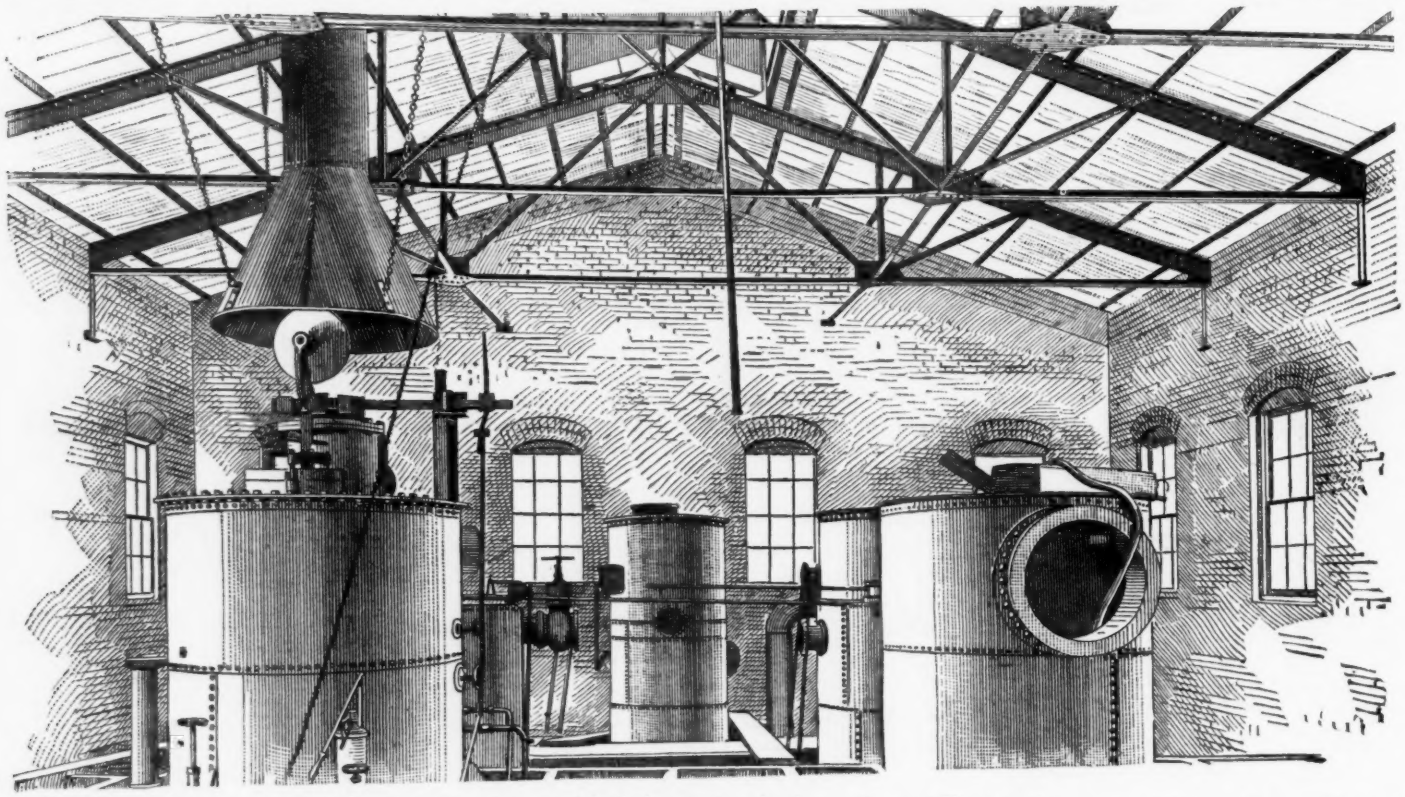

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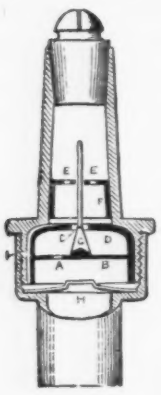

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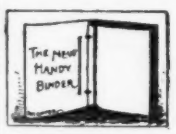

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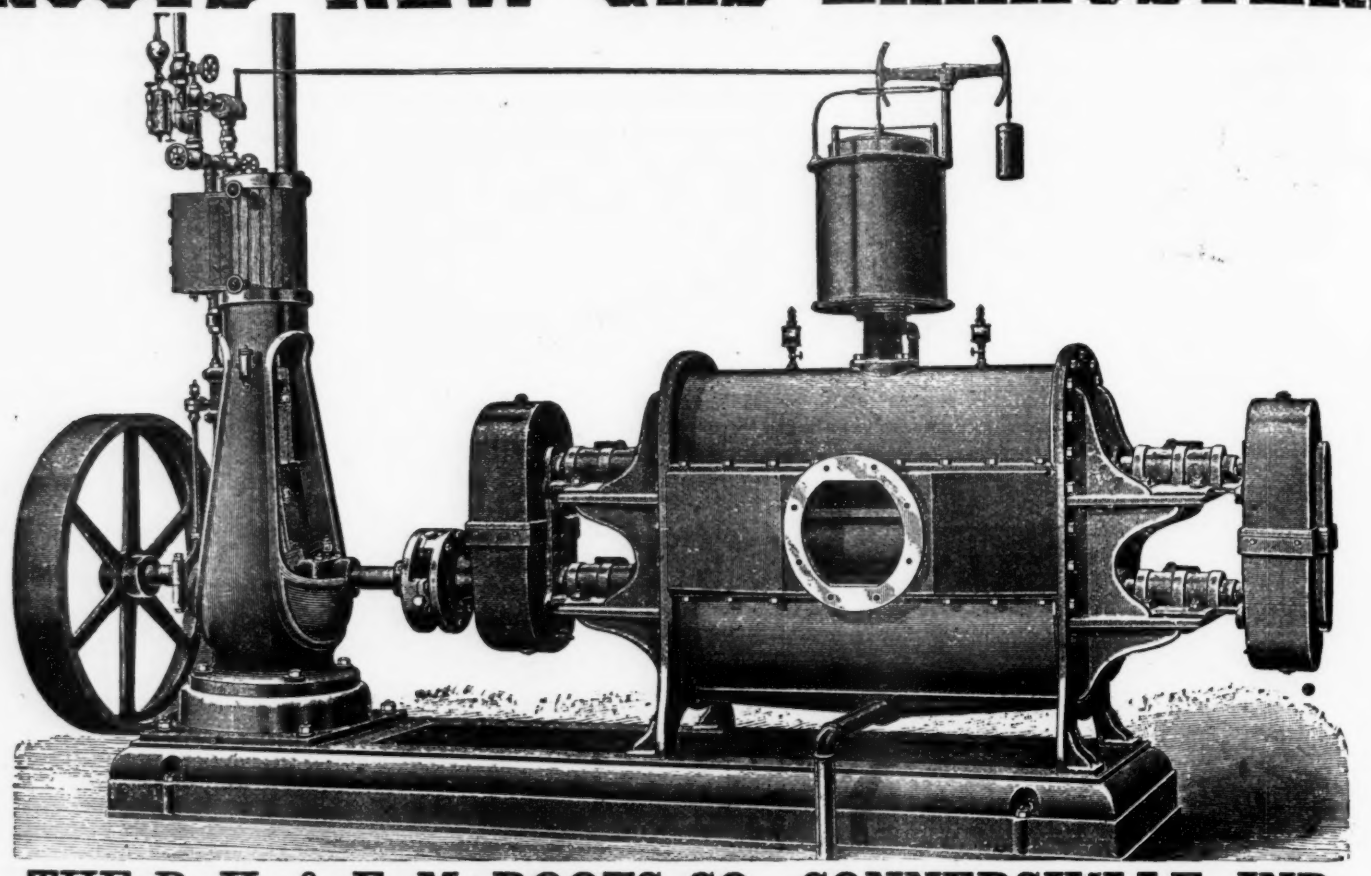

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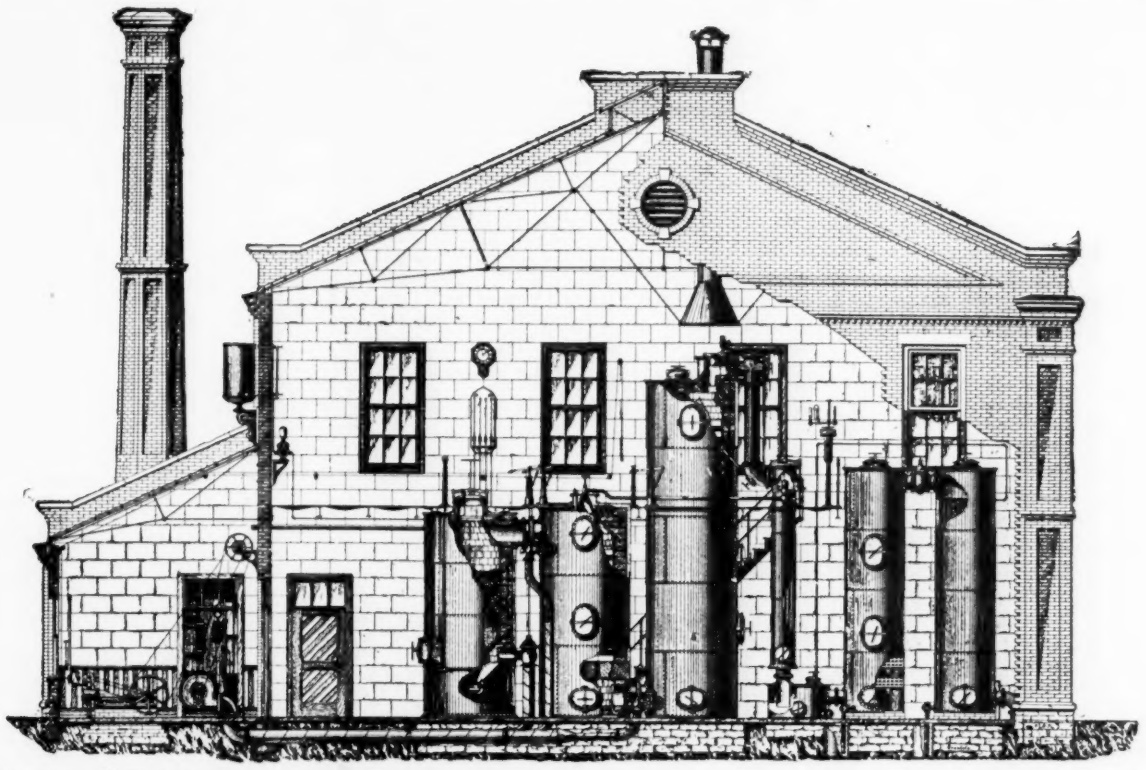

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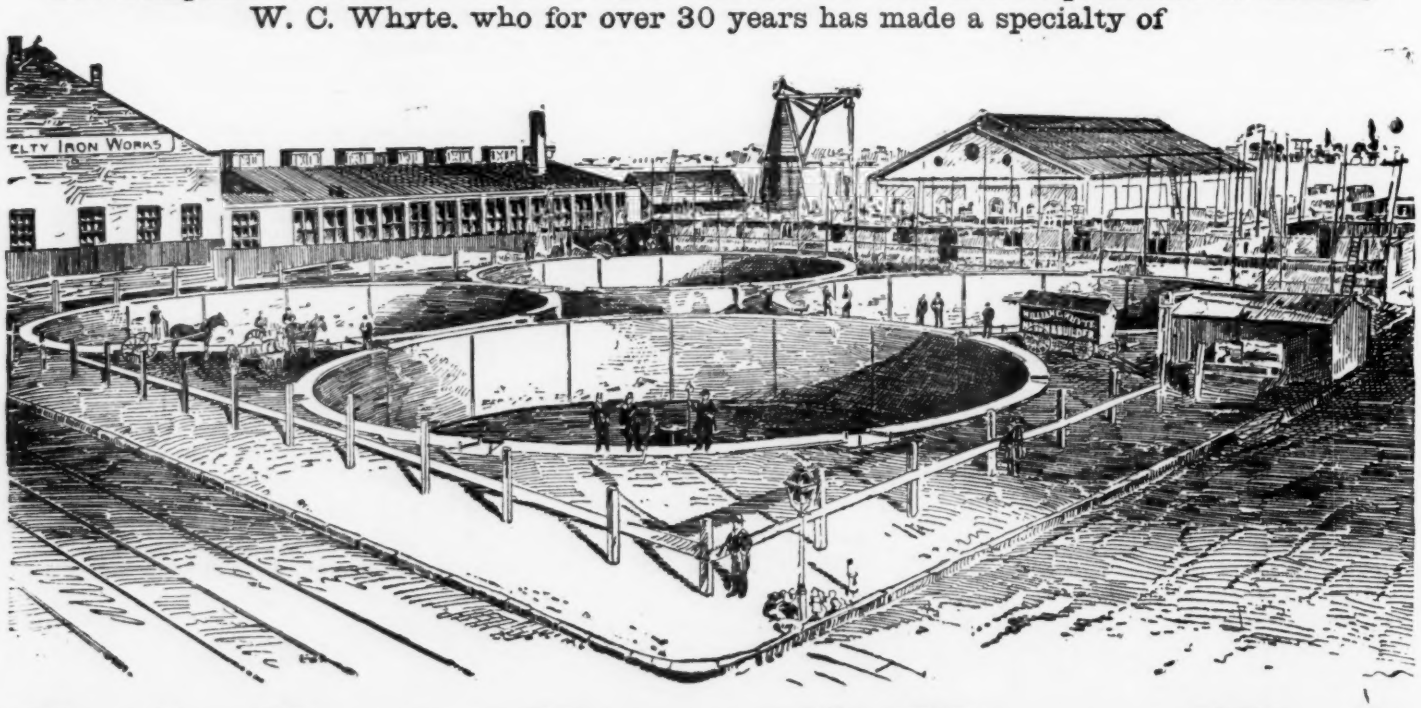

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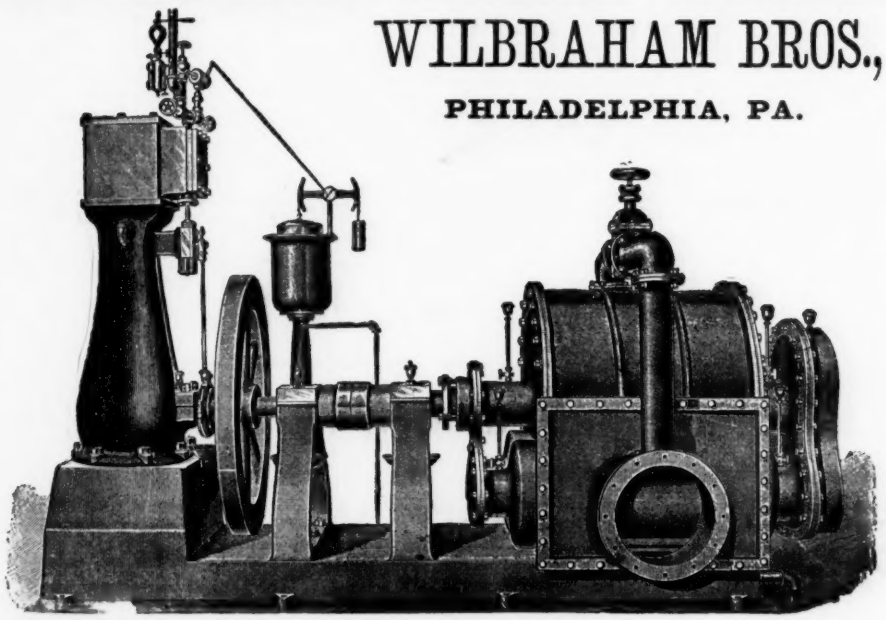

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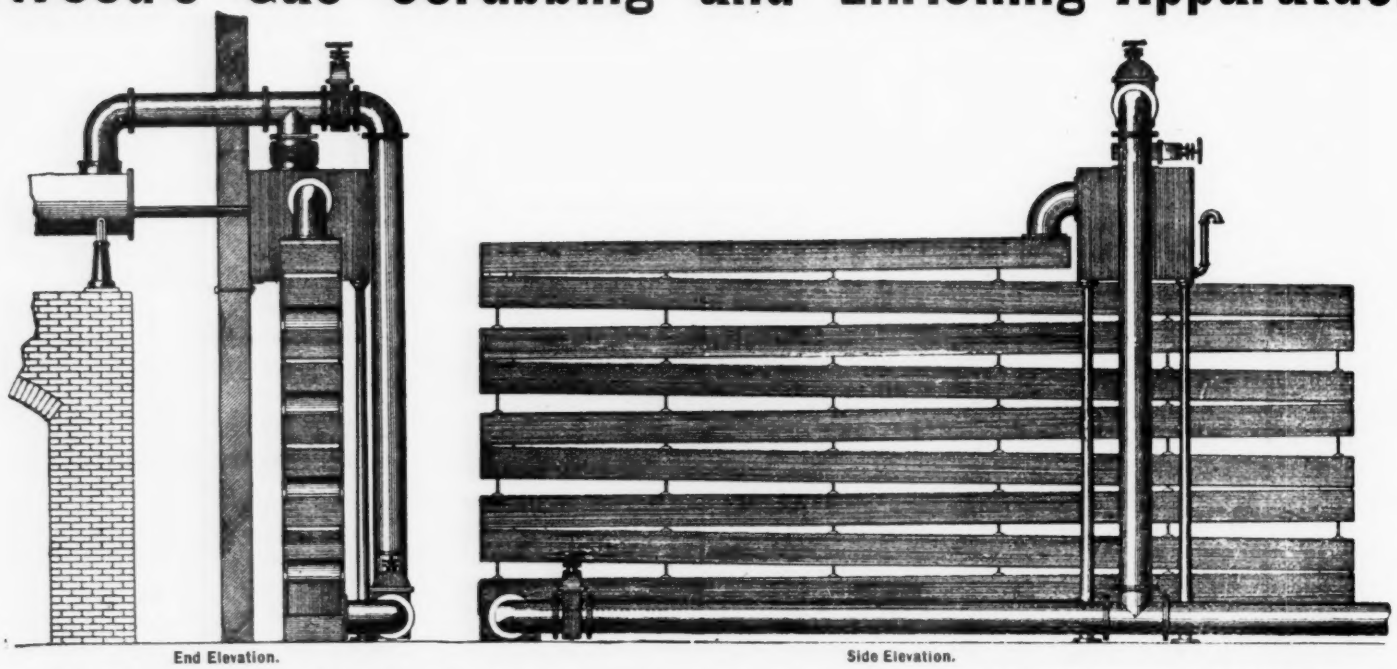

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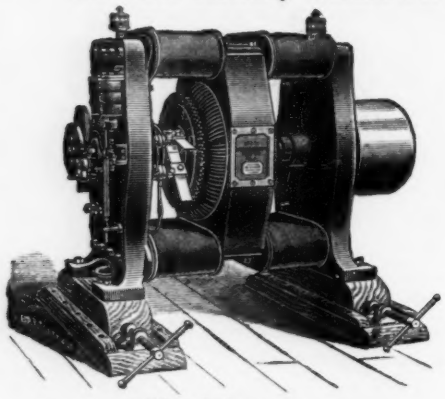

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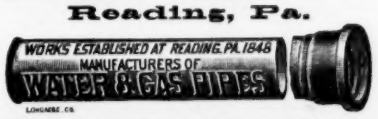

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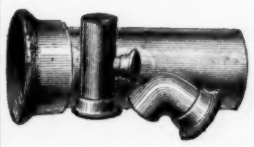

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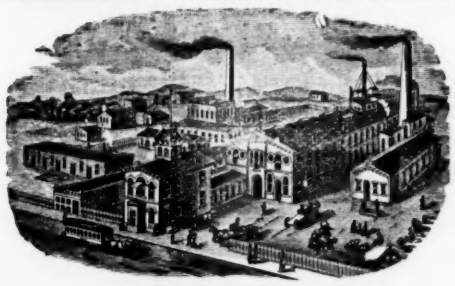

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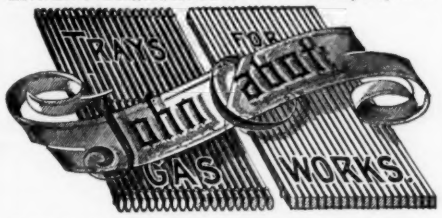

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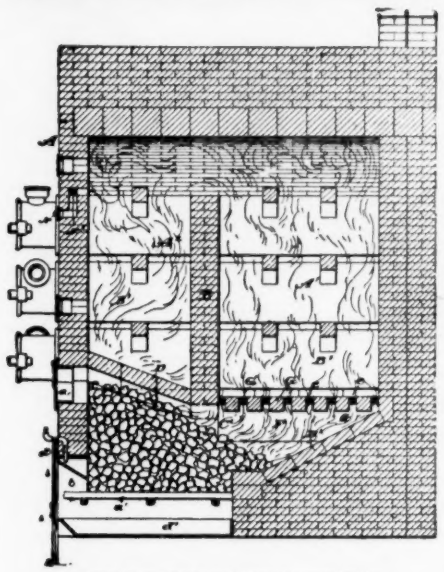

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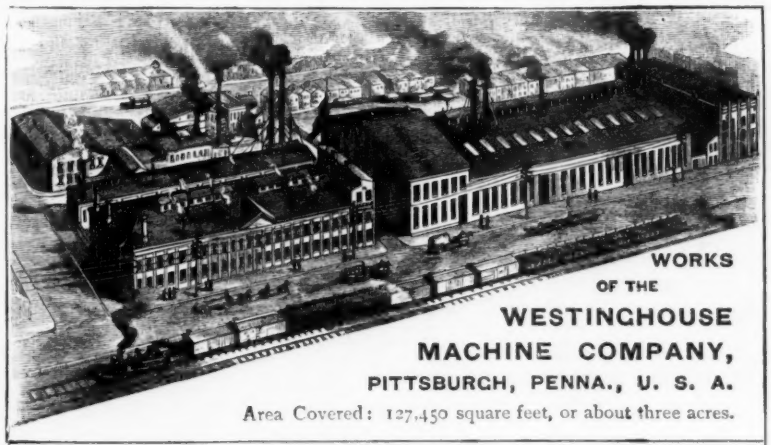

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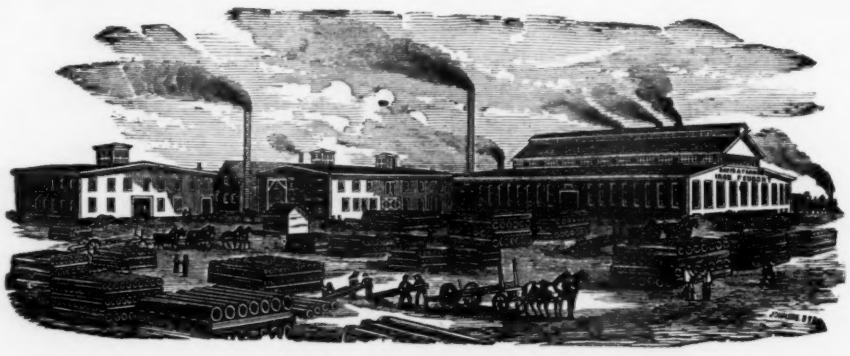

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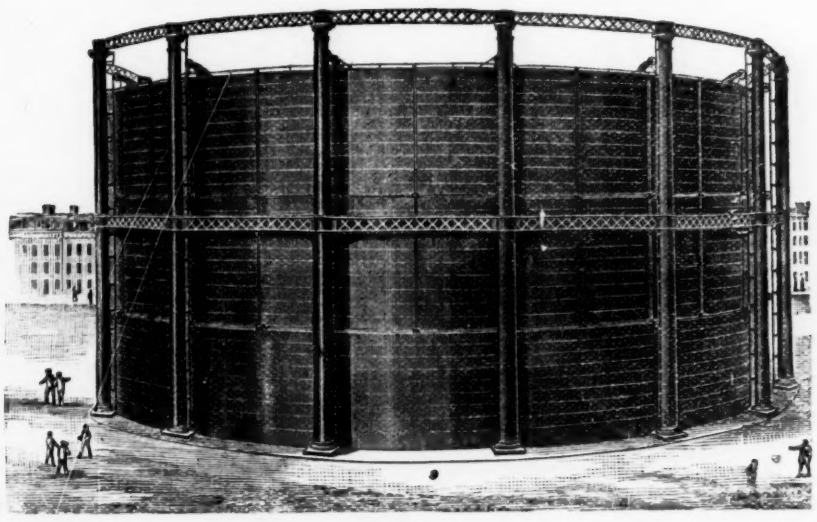

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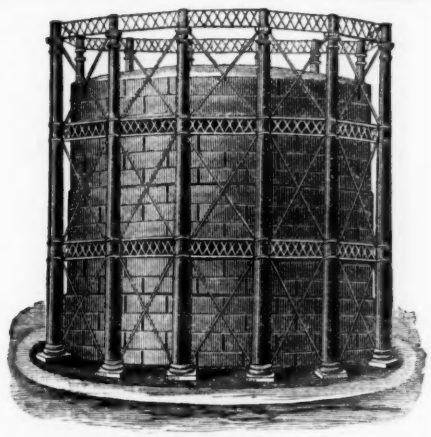

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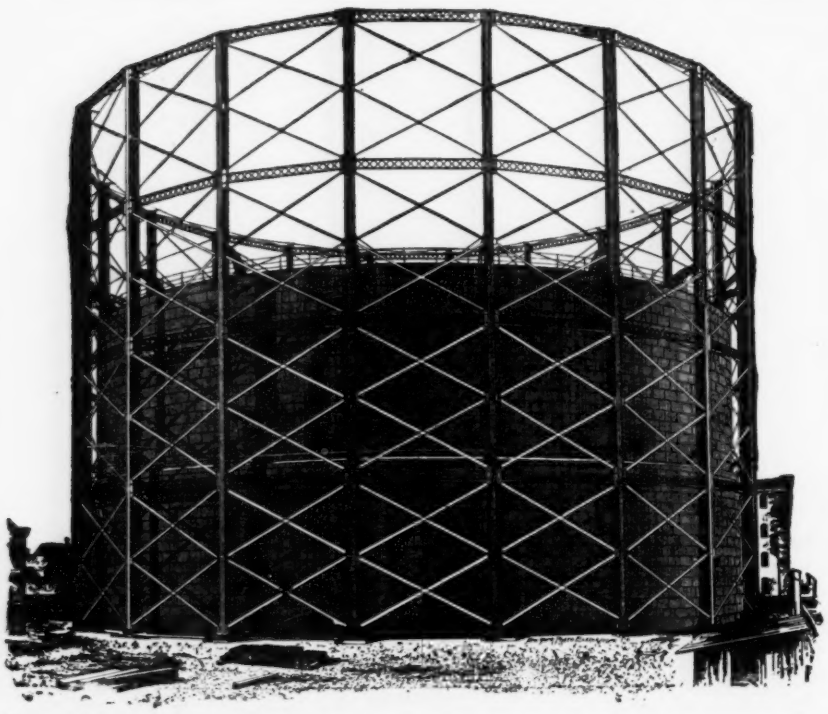

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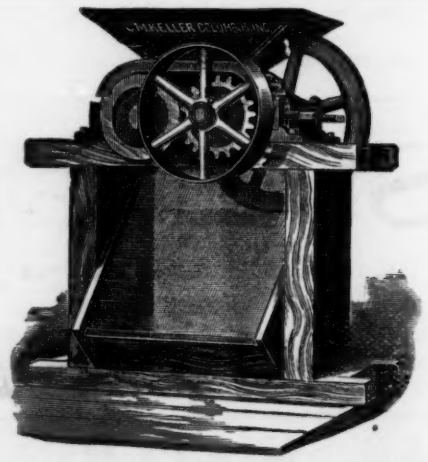

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31 inches high.	9⅜ inches high.	10 inches high.	5 inches high.
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